Vol.

THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Behind every manufactured product is the tool engineer

This is Herman Engstrom, one of P&W's top precision experts, demonstrating the accuracy of a Pratt & Whitney Jig Borer quill.

We moved Herman and his equipment right out of our shop into our booth in Chicago, so folks could see exactly what we mean by Pratt & Whitney Precision.

That ELECTROLIMIT Height Gage he is using will split "tenths." As he checked quills with it, there was hardly a flicker of the needle. Many a spectator asked if it was stuck! It wasn't!

That's typical P&W Jig Borer Precision — the kind that goes into the machine, and the kind that comes out. Boring jigs to "tenths" is routine for any P&W Jig Borer. Toolrooms all over the country have found new ways to cut costs and save time with this machine. Pratt & Whitney engineers can show you how.

If precision boring is a part of your picture, write TODAY for literature telling "the hole story."

Introduced for the first time in Chicago was the new P&W All-Electric Jig Grinder, which combines Jig Borer precision-locating with precision hole-grinding. This brand new machine is destined to make toolroom history. We will gladly send you complete literature.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

The Tool Engineer

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American Society
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Dec., 1947

Vol. XIX, No. 5

Editorial

PEACE ON EARTH . . .

AS WE APPROACH this Christmas season when people everywhere are thinking about "peace on earth and good will toward men", the thoughts of many of us in business and industry will logically turn not only to peace in our industrial democracy, but peace among nations.

Within the last few years, most of us have become convinced that professional men, and engineers of all kinds in particular, must function more effectively in the sphere of social responsibility. To insure the peace we are all seeking, both at home and abroad, we must become more proficient in the science of humanics and in the art of human relations.

Legislation and international rules alone are not enough to create and maintain the harmony necessary to bring about much needed production, and to operate our increasingly complex industrial system. We must supplement laws with understanding. We must implement the effectiveness of our system, with a fine spirit of mutual agreement, especially as to the social obligations each segment of our society owes to the other.

Most advanced thinkers are thoroughly convinced, for instance, that both honest management and honest labor are seeking identically the same goals. They are convinced also that both of these segments of our society are constantly reaching better basic understandings each with the other.

The most important thing we can do today, therefore, aside from keeping up with technical advancements and improving our production machine, is to work toward even better understandings . . . to devote some time, thought and effort to the solution of the many human problems that arise wherever men work together.

It is natural that in our business we hear a great deal about "mechanics", as our primary job deals with the development and application of machinery. It is quite likely that in the future we will be hearing a great deal about "humanics" which might be defined as the cultivation and application of the human machine. This human machine is more complex, more unpredictable, less understood, but generally more useful than the mechanical devices used by the human machine as extensions of man's abilities and capacities. It is axiomatic, therefore, that the most perfect of our mechanical developments cannot operate without the ingenuity and watchful eyes of human beings.

Hence, a study and understanding of these human machines is as important as the development of more and better tools which are but extensions of the usefulness and productivity of man's efforts.

As tool engineers, we must look at men both as tools and as human beings. We take great pains to understand the machines we utilize . . . but too many of us lack a proper understanding of the men, the human machines, which—in the final analysis—are much more important than the iron and steel mechanical contrivances over which we preside.

If we start now to mend our fences and build our social institutions on a firm foundation of real understanding and good human relations, we can avert the impending conflicts which are being bred by many opposing ideologies. The corner-stone laid on this foundation must be tolerance and the windows of this sturdy structure must be lighted with human friendship.

This Christmas, let's all determine to give more than lip service to the ideal of "peace on earth and good will toward men." Let's study, learn and practice better human relations in our daily work. Because upon these things devolve not only industrial peace in our nation, but peace among the nations of the world.

W. B. Peirce

President 1947-48

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PRODUCTION NEWS!!!

a new era in shaft-turning

The new BULLARD MAN-AU-TROL HORIZONTAL LATHE Model 30H produces three identical parts at once . . . with interchangeable manual or automatic control!

The new BULLARD Man-Au-Trol 3-Spindle Horizontal Lathe will enable you to *multiply* production on shaft-turning, grooving, facing, angle-turning or between-center chucking jobs — and to reduce costs proportionately. In addition, this latest BULLARD machine has many other improvements contributing to better workmanship and big savings in time and money.

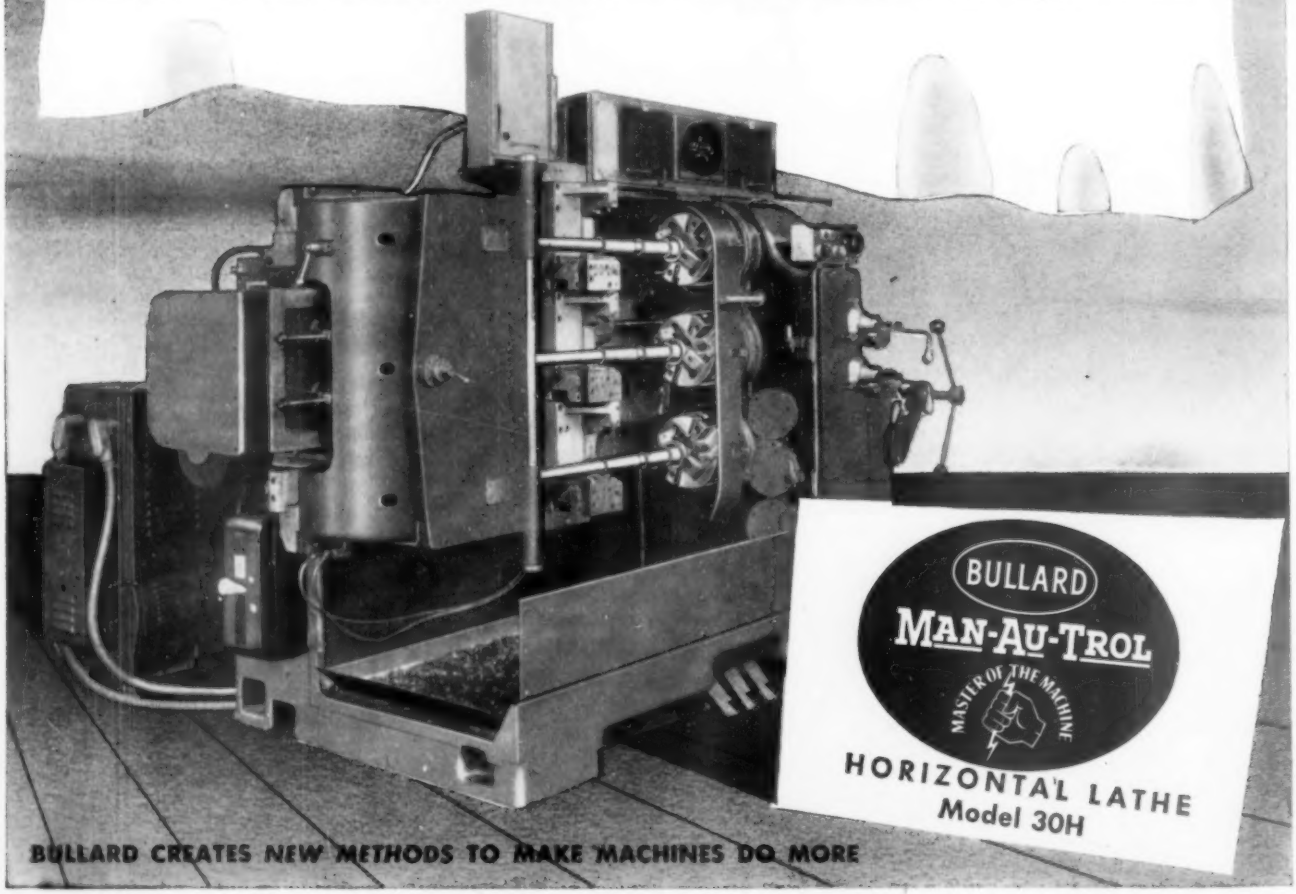
NO OTHER SHAFT-TURNING LATHE OFFERS ALL THESE ADVANTAGES

Hydraulic, centering-type chucks on all 3 spindles . . . each chuck operated by individual foot-treadle, freeing operator's hands . . . saddle and tool slide travel on vertical ways, free of chip area . . . full chip control, including automatic breakage for disposal, and prevention of accumulations around operating parts . . . complete visibility and accessibility of work and tools . . . massive weight and over-all rigidity assure minimum vibration for maintained accuracy . . . Man-Au-Trol control, head stock and all other machine-operating controls are at operator's right.

PLUS THE ADVANTAGES OF BULLARD MAN-AU-TROL

Providing manual operation on short runs, Man-Au-Trol enables quick conversion to 100% automaticity on longer runs. Controlling the head through *39 separate functions in any sequence*, it allows the machine to cut practically continuously, without stops for customary manual operations or loss of time due to the human element. While retaining the versatility of manual control for short runs, this new BULLARD machine can be quickly changed to fully automatic operation on production of 3 identical parts at once — substantially lowering manufacturing costs.

Why not find out how this cost-saving combination can benefit your own production? Engineering data and other facts on the new BULLARD Man-Au-Trol 3-Spindle Horizontal Lathe gladly sent on request. THE BULLARD COMPANY, Bridgeport 2, Conn.



HARDINGE
ELMIRA, N.Y.

HIGH SPEED

PRECISION PRODUCTION MACHINES

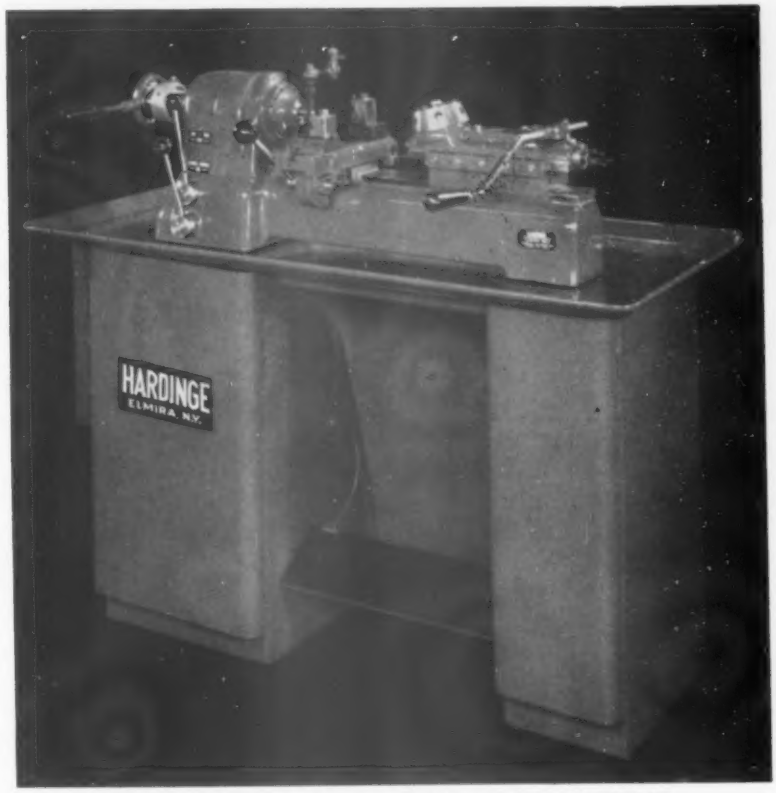
The production of precision parts today requires tool room accuracy with high speed operation to reduce and then maintain lower costs. These machines are both designed to increase the output of parts to extremely close tolerance and finish specifications. The precision qualities of these machines, combined with the simplicity of operation, assure lower costs.

SECOND OPERATION MACHINE: 1" collet, 6" step chuck, 5" jaw chuck capacity; eight spindle speeds to 4000 r.p.m.; preloaded ball bearing construction for spindle and turret; hardened and precision ground steel ways; turret and cross slide operating levers are adjustable to suit the operator.

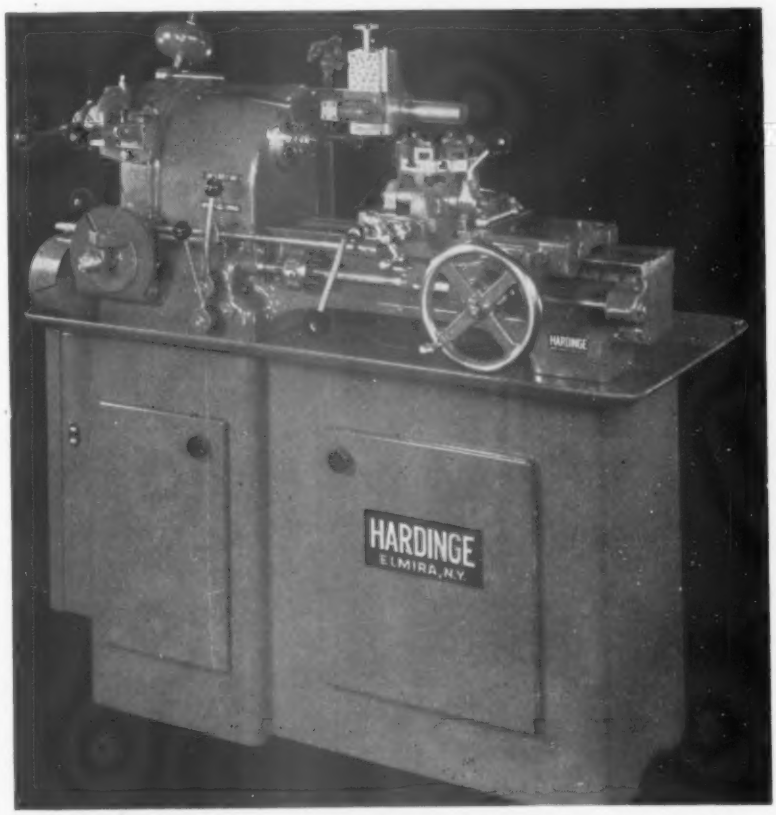
Write today for bulletin DSM59 which illustrates and describes the Second Operation Machine.

MULTI-OPERATION CHUCKING MACHINE: This machine has the same capacity as the Second Operation Machine. In addition, it has an eight-position turret, production threading head and power feed for the carriage.

Write today for bulletin HP which shows how this machine can handle various jobs, using standard tool bits only . . . for low-cost tooling.



HARDINGE SECOND OPERATION MACHINE

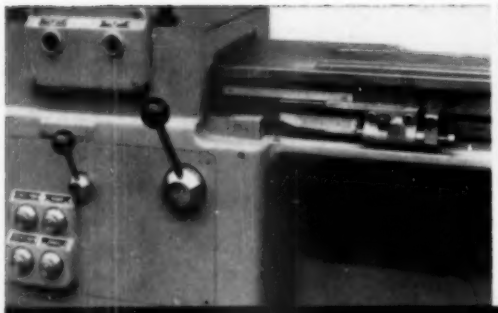


HARDINGE MULTI-OPERATION CHUCKING MACHINE

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

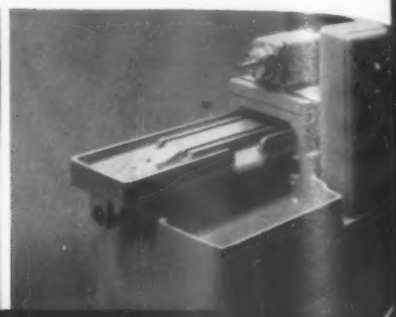
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Compact design means simple operation



Centralized controls and easily adjusted table dogs

Complete power unit detachable from base



Large chip pan and built-in electrical control box

on the NEW SMALL HEALD BORE-MATICS

ANOTHER OF 18 NEW HEALD MACHINES

Single or double end high-precision machines for small work

SMALL IN SIZE and simple in design, these new Bore-Matics are ideally suited to both large and small shops. They can be tooled for one or several parts to bore, face, turn, chamfer groove or fly cut — yet they operate very easily.

Among the features in design are: knee-hole construction; capacity for two spindles at each end; complete control of heat and vibration; permanently lubricated, cool-running boringheads; self-adjusting, quick acting brakes; leakproof hydraulic system — all of which require negligible maintenance.

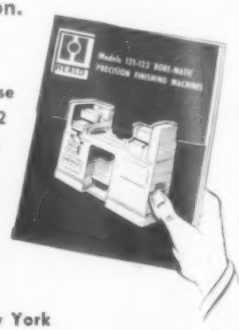
These new, small Bore-Matics are extremely accurate, productive and efficient with —

EXTREMELY FAST OPERATING CYCLES — high table traverse speeds, and faster boringhead speeds.

UNIFORM SPEEDS AND FEEDS — *remain constant* throughout the day without adjustment.

TWO-WAY BORING — different rates of "in" and "out" feeds available.

Write Heald branch office nearest you for further information.



FREE BULLETIN on these new Heald No. 121 or 122 Bore-Matics lists complete features and specifications. Send for your copy today.

HEALD

THE HEALD MACHINE COMPANY, Worcester 6, Mass.

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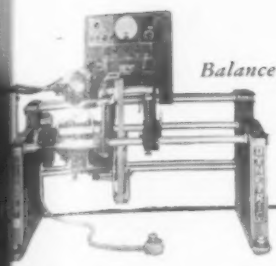
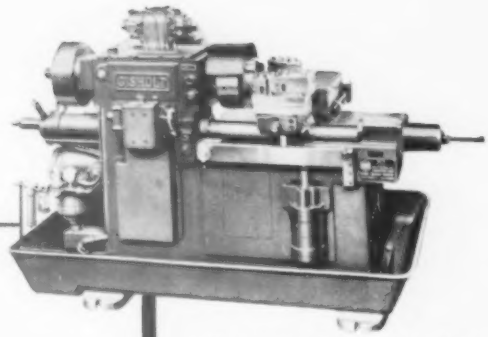


Balancers

Superfinishers



Hydraulic Automatic Lathes

If you produce parts that are Round or Partly Round

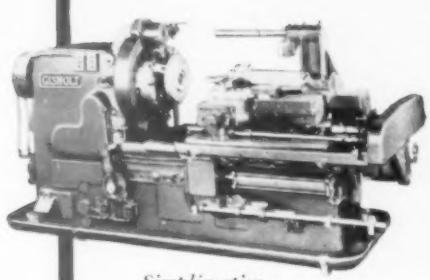
meet us at the "GISHOLT ROUND TABLE"

Yes, for a half century, here at Gisholt, we've concentrated our efforts upon the building of equipment to produce parts that are round or partly round. And a good share of our job is helping others to use it most efficiently.

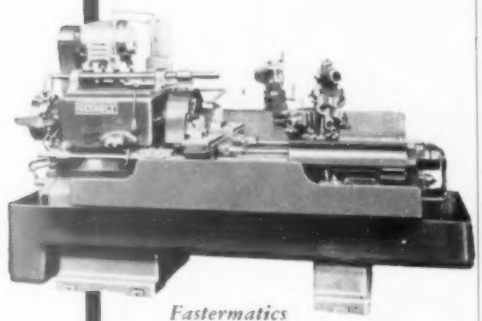
There's where the "Gisholt Round Table" comes in—as a clearinghouse for practical ideas. Gisholt engineers live with production problems day in and day out, visiting hundreds of plants each year. Whatever your work may be in the realm of machining, surface-finishing or balancing of round or partly round parts, Gisholt specialists will gladly help you.

Now, and in the years ahead, more emphasis than ever will be placed upon better methods, increased efficiency and lower costs.

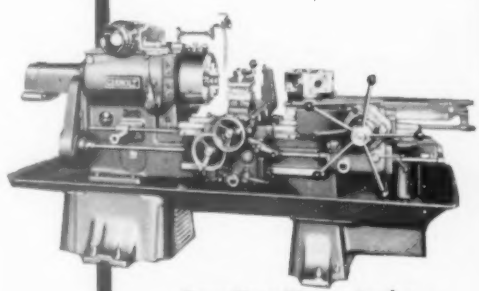
Call your nearest Gisholt Representative. Or, if you wish, come to Madison and consult the "Gisholt Round Table."



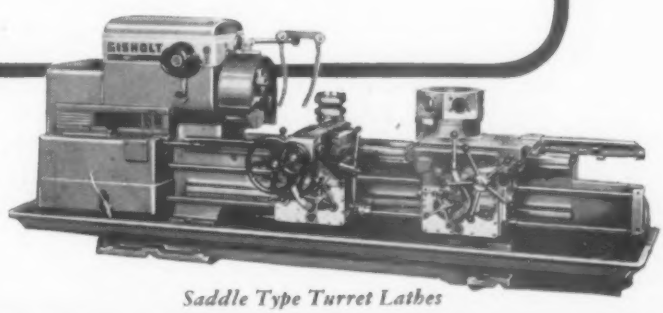
Simplimatics



Fastermatics



Ram Type Turret Lathes



Saddle Type Turret Lathes

GISHOLT MACHINE COMPANY

Madison 3, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS
BALANCERS • SPECIAL MACHINES

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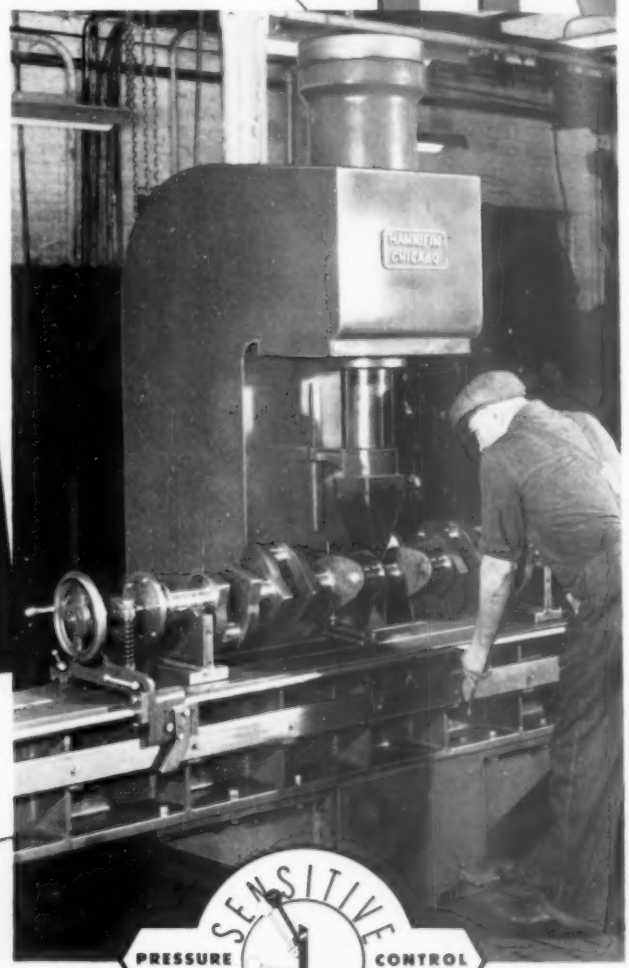
Saves time...
PAYS FOR ITSELF!

BY reducing the number of machine and man-hours required for grinding . . . by minimizing rejects . . . by making for a better finished product, this Hannifin hydraulic straightening press pays for itself! The use of straightening presses for truing parts after heat treating and before grinding is well-known, yet there are still many places where the opportunity to make savings is overlooked. Hannifin engineers will be glad to supply recommendations on the press best suited to meet your requirements. See your local Hannifin representative, or write.

HYDRAULIC *straightening* PRESSES



ONE OF MANY DIFFERENT TYPES

35 ton Hannifin straightening press with 90" table. Ask for a copy of Bulletin No. 60-J

SENSITIVE PRESSURE CONTROL Variable

TYPICAL USES—

Hannifin presses are widely used for straightening crankshafts (as illustrated above at the right), axle shafts, cam shafts, line shafts, lathe spindles, machine tool guide rails, cylinder stock, gear countershafts, splined shafts, piston rods, and airplane propellers. Thanks to Hannifin's exclusive "Sensitive Pressure Control" any workman can easily and quickly true parts to required tolerances.

MODERN CONSTRUCTION. Frames welded from steel plate. Normalized before machining. Strength and rigidity without excessive weight.

QUALITY FEATURES. Cylinders TRU-BORED and honed. Tight-sealing precision type piston rings. Sensitive Pressure Control.

STANDARDIZED DESIGN. For earlier delivery, lower cost.

SIZES. A choice of 16 standard sizes ranging from 6 to 150 tons. Each press easily fitted to meet your special requirements.

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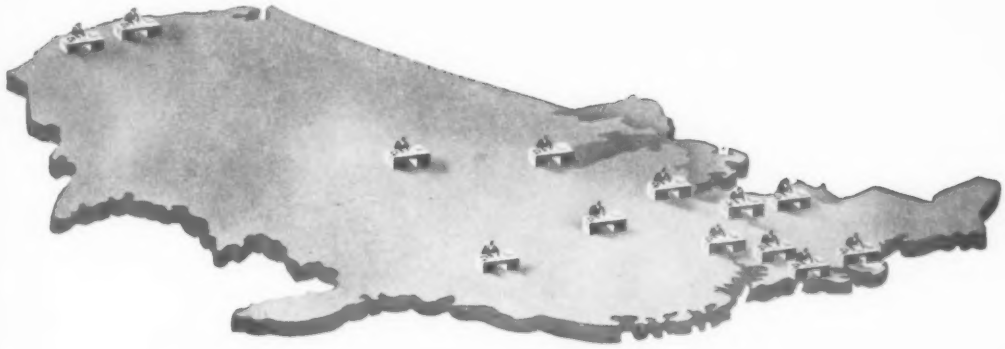
A BUYING GUIDE FOR ABRASIVES

POINT No. 11



District Representation

Certain buyers of abrasives find the measure of their sources of supply in the local representatives of abrasive manufacturers. Therefore, it is a matter of great satisfaction to us to have men of ingenuity and experience representing us in key locations throughout the country. It is by means of our district organization that users are given direct access to the engineering, research, and wide scale technical activities of The Carborundum Company. It is their intelligent handling of abrasive problems, and their sincerity in serving customers' needs that makes every user think first of CARBORUNDUM, when they think of abrasives. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM

TRADE MARK

BONDED ABRASIVES

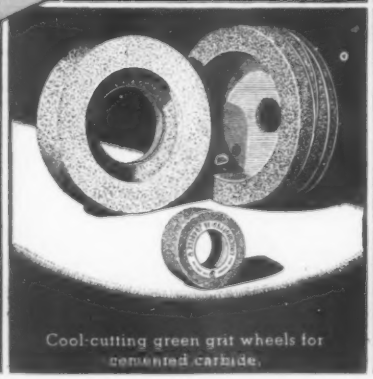
COATED ABRASIVES

ABRASIVE GRAINS AND FINISHING COMPOUNDS

Specialized wheels by CARBORUNDUM for thread grinding.

Diamond wheels to meet stiffer technical needs.

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company.



Cool-cutting green grit wheels for cemented carbide.

A coated abrasive for every sanding and finishing condition.

All standard shapes are supplied in grinding wheels by CARBORUNDUM

THE BEST GAGE IS ALWAYS A ***STURDY*** *GAGE*

SENSATIONAL WEAR LIFE!!

Up to 200 TIMES *the life of ordinary gages with* STURDY NORBIDE GAGES

Sturdy Norbide★ Gages Outwear ordinary gages hundreds, even thousands of times. On-the-job tests in one instance proved that hardened tool steel gages wore out in four hours, chrome plated tool steel in eight hours, tungsten carbide in two weeks. *After five months,* Sturdy Norbide★ gages showed less than .00001″ wear . . . with no indication that they would wear out in another 12 months!

Lower Production Costs! Sturdy Norbide★ Gages with sensational wear life create dollars and cents savings whenever used! Not only are initial costs low—upkeep and gage inspection is safely reduced to an amazing minimum . . . and Norbide's next-to-diamond-hardness will not scratch or mar the finest super-finish.

Sturdy's great success in applying Norbide to gage and precision tool manufacture has earned Sturdy a prominent place in the field of processing ultra hard materials. To Sturdy, belongs much of the credit for establishing Norbide as a workable material of unique, long-wearing qualities, well adapted to gaging and precision tool operations. Sturdy's research and skilled personnel are at your service. You are invited to make use of it to solve your gaging and precision tool problems.

★ *Registered Trade Name*

SEVEN GREAT ADVANTAGES

Sensational long life—outwears tungsten carbide.
Doesn't warp or creep—forever accurate.
Doesn't scratch or mar the finest finish.
Non-Magnetic—will not pick up grinding grit or metal chips.
Excells on rough finishes.
Norbide is the hardest material made by man.
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Low initial cost.

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★ Precision Tools and Gages of Norbide, Steel, Chrome Plate, Stellite and Tungsten Carbide.

Norbide Inserted Anvil

Norbide Inserted Snap Gage

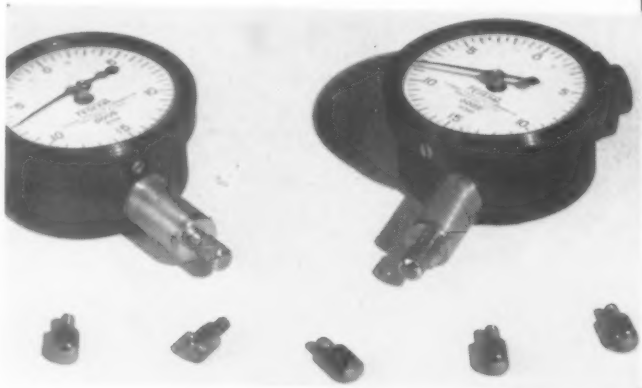
Norbide Grading Plug Gage (with .0001 graduations)

Of extreme importance with the five step Sturdy Norbide plug gage is its exceptional lightness (lighter than aluminum) which affords the operator greater sensitivity or "feel" and less fatigue.

If there is a Wear Surface on a Gage...
Wear-resistant **NORBIDE** *parts save Time and Money*

NORBIDE Gages are made of Norton Boron Carbide—the hardest material commercially produced—and it is this hardness which gives them their wear resistance. A NORBIDE plug gage measuring aircraft engine parts lasted 17 months where tungsten carbide lasted 14 days, chrome plated gage eight hours, tool steel gage four hours.

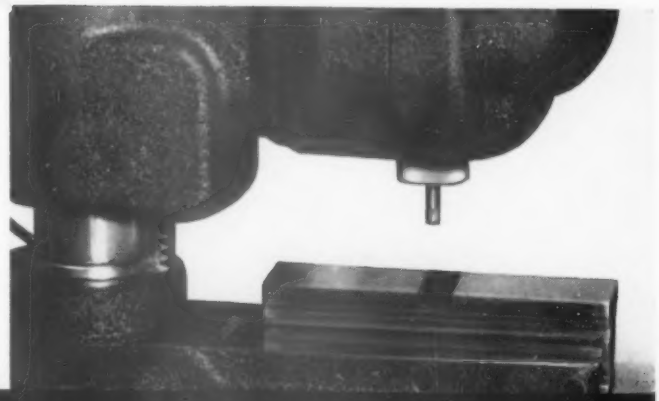
A new application of NORBIDE pieces is shown at the right where three rectangular NORBIDE inserts were used on an angle face plate. On last report this gage had been in service for six months of checking for truth or run out as well as diameters of aircraft engine flanges. The hardened steel plate formerly used required resurfacing every 24 hours.



Contact points for dial indicator gages is a common use for NORBIDE shapes. NORBIDE gages will not pick up lint nor become charged with particles of metal. They are inert to chemicals ordinarily employed where gages are used. Because NORBIDE pieces weigh even less than aluminum, NORBIDE gages that are held in the hand cause much less fatigue.

NORBIDE inserts are successfully used in the anvils of many gages. Because of their great wear resistance these anvils do not have to be constantly resurfaced, wear tolerances are eliminated and rejects are cut to a minimum. Ask your regular supplier about NORBIDE Gages or write to:

NORTON COMPANY, Worcester 6, Mass.



NORBIDE – The Hardest Material Made by Man

T. M. REG. U.S. PAT. OFF.

NIAG

The modern appearance of these Niagara Presses is significant of the talent and experience responsible for their functional design. Motor, flywheel, clutch and all gears are enclosed within the frame. They are widely used throughout industry.

The advanced design of Niagara Underdrive Shears makes possible accuracy plus high output per hour. Strong, rigid bed, crosshead and housings eliminate the necessity for continually adjusting knife clearance for each thickness of sheets. No exposed rotating shafts, eccentrics or belts. Write for bulletins.

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GARA

PRESSES

SHEARS

DISTRICT OFFICES — NEW YORK • CLEVELAND • DETROI

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GREEN—GO

RED—NOT GO

Industry by industry—coast to coast—wherever accuracy and durability count—Woodworth Company is winning and holding new friends—with the *ACCEPTED ADJUSTABLE THREAD RING GAGE.*

ACCURACY YOU CAN TRUST

SEND FOR—The new 1948 Woodworth Gage Catalog just off the presses. Requests for copies must be written on company letterheads.

★There's a Woodworth representative near to serve you. Write us for his name.

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Starrett

HACKSAWS and BAND SAWS

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MORE CUTS PER DAY

MORE CUTS PER SAW

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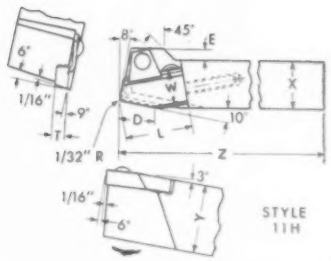
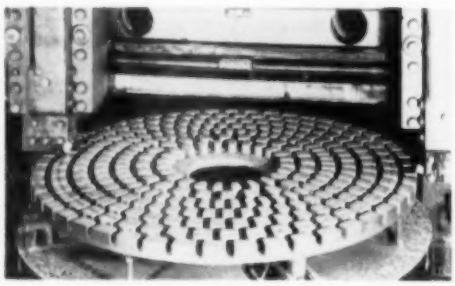
IF Interrupted Cuts Are Your Problem

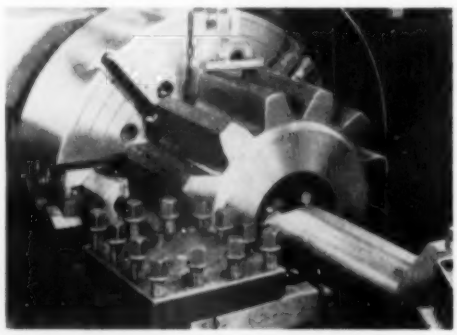
Learn About Kennametal



Style 11H is one of a complete line of Kennametal tools, having sturdy, clamped-in, advanceable Kennametal tips. This assembly—developed by Kennametal—is highly successful on interrupted cutting, and is equally outstanding on continuous-cut operations. It utilizes Kennametal's high strength to best advantage—provides a thermally-strain-free assembly; makes possible deep cuts and heavy feeds; simplifies grinding since tip is advanced and re-sharpened without removing any steel from shank; and enables practically all of the Kennametal tip to be utilized for cutting.



This iron casting has 288 chilled lump interruptions. A Kennametal standard Style 11T80 tool faces and turns it at 190 ft./min., .048" feed, and ¼" depth of cut.



Kennametal bores, turns, and faces over interruptions and sand holes on this chrome-nickel steel rack pinion. Speed—155 ft./min.; feed—.032"; depth of cut—¼" to 5/16". Performance is 5 to 1 over high speed steel tools in production and pieces per grind.

You're probably enjoying the advantages of carbide tooling on continuous-cut operations—but how about interrupted cutting?

Has this given you tool trouble, and made you resort to slower machining methods on some important jobs?

If so, Kennametal will help you solve this problem. Its ability to withstand the shock of interrupted cuts, on both cast iron and steel, has been unequalled.*

Although cutting conditions are often improved by changing the tool shape so that the shock will be imposed on a section of the tip that is stronger and better supported, it is still the carbide that must take the punishment. Here's where Kennametal has a distinct advantage.

Because of exclusive processing methods and careful control in manufacture Kennametal's impact strength is unusually high for such a hard material—as great as that of hardened alloy steels having much lower hardness and compressive strength.

Still further advantages for interrupted cutting are obtained by the use of mechanically-held tools developed by Kennametal Inc. Tips of characteristically high impact strength are securely clamped to, and firmly supported by a heat-treated steel shank, to provide an exceptionally strong strain-free assembly.

If you have had difficulty with carbide tools on interrupted cuts, let us engineer Kennametal to the solution of your particular problem.

** Ask us to send you a set of Performance Reports that demonstrate the superior results obtained with Kennametal Tools on interrupted cutting.*

Trade Mark Reg. U.S. Pat. Off.

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LATROBE, PA.

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Wear Tests of Plastics

An investigation of physical and mechanical properties of synthetic materials with relation to wear

by Dr. (Ing.) N. N. Sawin

ACCOUNT IS GIVEN in this article of numerous wear tests of different kinds of plastics. These concern synthetic materials used in the manufacture of bearings, bushings, gears, rails, and divers parts for automobiles, airplanes, electrical equipment, and machine tools, as well as in the production of general engineering parts and household appliances. While, however, plastics are lightweight materials, of sufficient strength for purposes used and of good machinability, a low modulus of elasticity hampers their application in fits with very small tolerances. See comparisons below:

Modulus of Elasticity; pounds per square inch	Laminated Materials	Bearing Bronze	Steel
	1,000,000 — 1,420,000	16,000,000	30,000,000

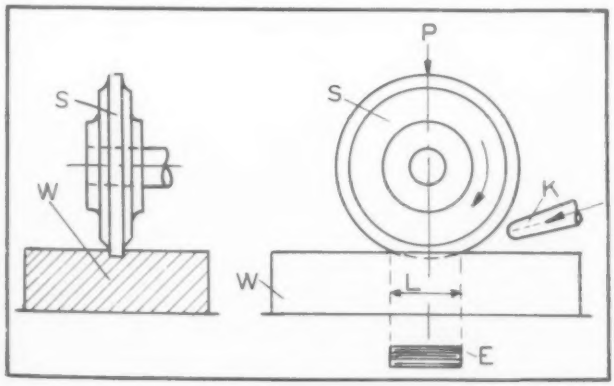
In plastic bearings, there is danger of overheating because of their low heat conductivity. This often requires the application of a special coolant at temperatures above 212°F—for instance, in bearings used in connection with rapidly rotating shafts.

Dr. N. N. Sawin has been a contributor to international engineering literature, on production processes, for many years. Until the outbreak of the revolution in Russia, 1917, when he had to leave, he was professor at the Polytechnic Institute in St. Petersburgh (now Leningrad).

Until recently he was connected with the Skoda Works, but had to leave again, owing to political pressure, with loss of all possessions. At present, he is resident in Upper Austria, U. S. Zone. For this important contribution we are indebted to Dr. A. O. Schmidt, Kearney & Trecker Corp'n, Milwaukee, who has acted as intermediary.

Publications on plastics, investigation of their physical and mechanical properties, and the description of their practical application, were numerous before and during the war. Among the large number of research reports, however, information relating to wear was entirely lacking. However, knowledge of numerical values of the wear of plastics, in relation to similar work with metallic or other materials, is very important for the designer as well as for the ultimate consumer.

FIG. 1. Principle of the Skoda-Sawin Machine: S, Wheel; W, Testbar; K, Coolant Nozzle; E, Wearmark; P, Load on Wheel.



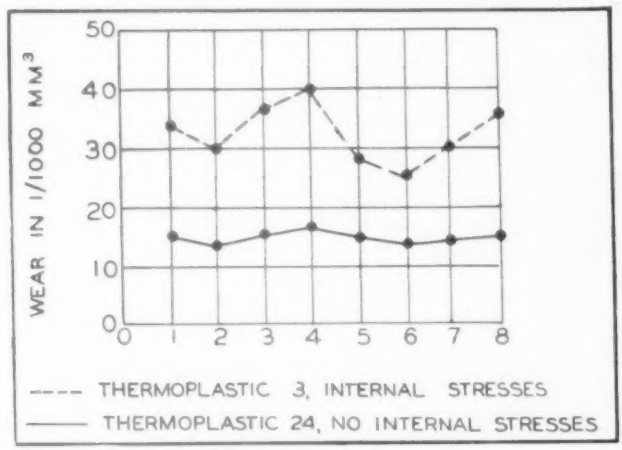


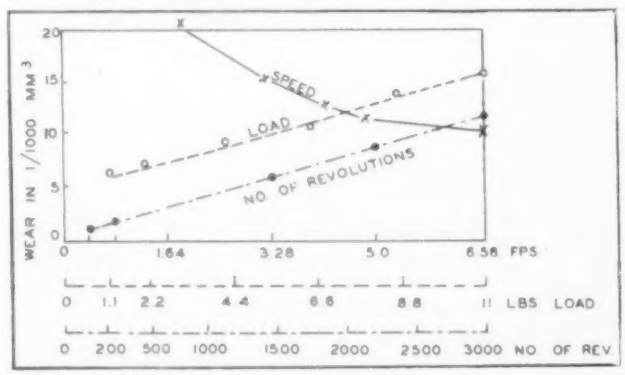
FIG. 2. Values of Wear in Different Locations on the Test Bar.

Materials Tested:

1. Synthetic resins in which phenol and formaldehyde are the principal basic materials.
2. Laminated materials, with 50 percent of resin, consisting of a number of cloth layers pressed between heated plates at 2500 - 2800 lbs. psi.
3. Plywoods, with a resin content of 15 to 30 percent, composed of a number of thin sheets of wood put one upon another under a pressure of 1500 to 7500 lbs. psi. (The pressure is applied in open or closed molds).
4. Scraps of plywood (0.15 sq. in.) 0.004" to 0.020" thick, used as a filler saturated with a water solution of Phenol-Cresol resin and pressed into molds to obtain finished or semi-finished parts.

In order to facilitate fastening them in the testing machine, testpieces 2" x 1-3/16" x 13/32" and 4" x 51/64" x 13/32" in size were cut from large plates.

FIG. 3. Wear of a Thermoplastic Material Tempered for 24 Hours, in relation to Speed, Load, and Number of Revolutions.



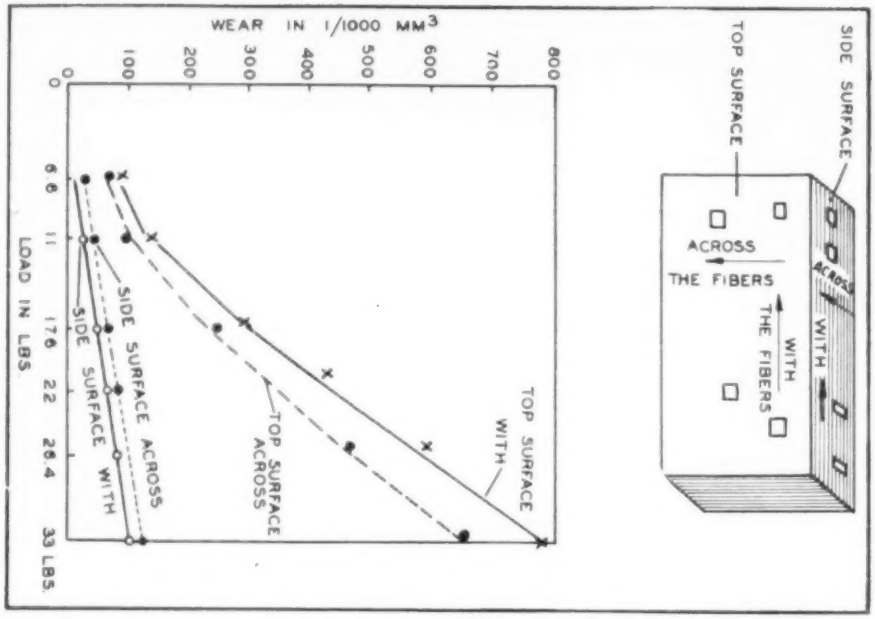


FIG. 4. Laminated Coarse Cloth Plastic. Effect of the load on wear at 3.281 feet per second speed.

The load on the wheel can be varied within limits of 0 to 55 lbs. With the aid of pulleys and a gear box, it is possible to obtain different circumferential speeds of the wheel from 0.4 to 8 feet per second. During the test, the work (in the shape of a prism) as well as the wheel are cooled to room temperature by a heavy flow of coolant composed of a ½ percent solution of potassium chromate ($K_2 Cr O_4$).

After a certain number of revolutions of the wheel, the machine is stopped and the microscope is swung over the impression formed in the test bar. By means of moving threads in the microscope, the length of the impression is measured and the volume thereof is determined from tables in 1/1000 cubic millimeters. The accuracy of results obtained on the machine is equal to ±6 percent.

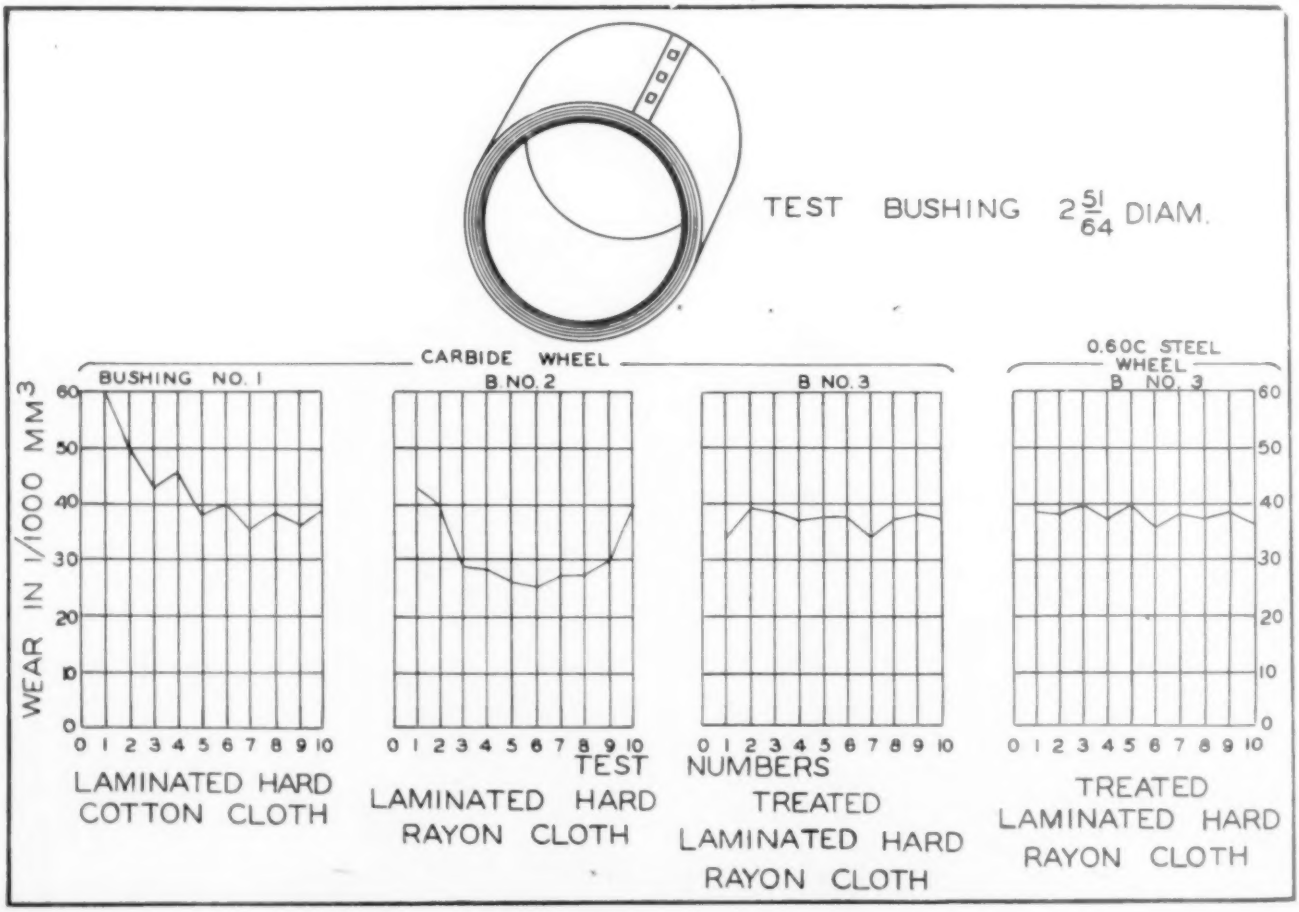
Test Procedure

The wear tests reported herein were performed on the Skoda-Sawin* testing machine, the principle of which is shown in Fig. 1. The tool is a standardized tungsten-titanium carbide wheel 1-3/16" in diameter and 0.100" thick. This wheel, of sintered carbide is unaffected by wear when testing plastics.

The changes in the grinding ability of the sintered tungsten carbide wheel, in relation to the type of material tested, are generally not of essential importance. The principal factor is the work of the small wear particles between the wheel and the test bar, the sintered carbide wheel serving merely as a solid unchangeable support for these particles. A sufficient impression in the tested material can usually be formed with 3000 revolutions of the sintered carbide wheel. The work of the wear particles, among themselves and on

*Prof. N. Sawin. "The Effect of Surface Stress on the Wear of Metals," Machinery, (London), Vol. 50, May 6, 1937. "Verschleisspruefung von Kunststoffen", Maschinenbau and Waermewirtschaft, (Vienna) Vol. 1, No. 5/6, 1946, pp. 103-198.

FIG. 5. Values of Wear of three Bushings of Laminated Fine Cloth Plastic No. 1, 2, and 3. Tested with sintered tungsten carbide wheel and 0.60 C. steel wheel at 11 lbs., 3.281 feet per sec., 3000 revolutions along the fiber on the top surface.



the test bar, acquires a constant character. Thus, the numerical values obtained characterize the wear of the tested material by its own wear particles in powder form.

The analysis of wear phenomena, when testing different materials with the carbide wheel, clears up the important role which the wear particles play and represents an interesting aspect of the theory and practice of wear of finished machined parts.

In repeated tests, the degree of scattering of wear test values depends, primarily, on the homogeneity of the structure of the materials tested. The combination of test conditions (circumferential speed, load, and the number of revolutions of the wheel) may also influence the degree of scattering.

A great number of tests of synthetic materials established that a load of 11 lbs. (5 kg.), circumferential speed of 3.281 feet per second (1 meter per second), and an average of 3000 revolutions for the carbide wheel, are the most advantageous conditions for testing all kinds of these materials.

Typical Results of Testing

Thermoplastic resin in the untempered state appears as a material with a very uneven structure and great internal stresses; therefore, the values of wear vary from −80 percent to +150 percent from the average value. The nonhomogeneity of the structure and great internal stresses are distinctly seen in polarized light. After 6 hours of tempering at 212° F however, the structure becomes more even and the stresses apparently disappear. Material which has been tempered for 24 hours is quite uniform; the wear decreases and is constant.

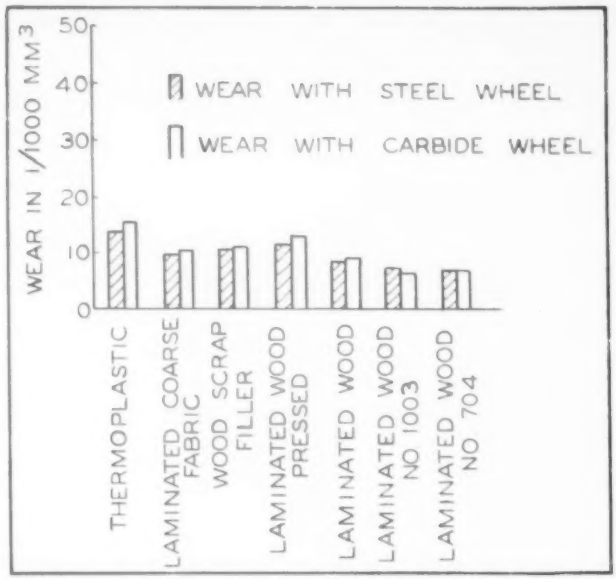


FIG. 6. Comparison of Wear Values of 7 Synthetic Materials. Tested with two wheels, sintered tungsten carbide and steel, on the side surface at 11 lbs., 3.281 feet per sec., and 3000 revolutions.

With an increase of load on the wheel, or with an increase in the number of revolutions of the wheel, wear increases linearly. A great number of tests have shown that all synthetic materials follow the same law in respect to speed and load on the wheel.

Fig. 2 is a diagram indicating wear of Dekorit (a thermoplastic resin) under normal conditions of testing with the carbide wheel, after 3 and 24 hours, respectively, of tempering. The relation of wear of Dekorit, after 24 hours of

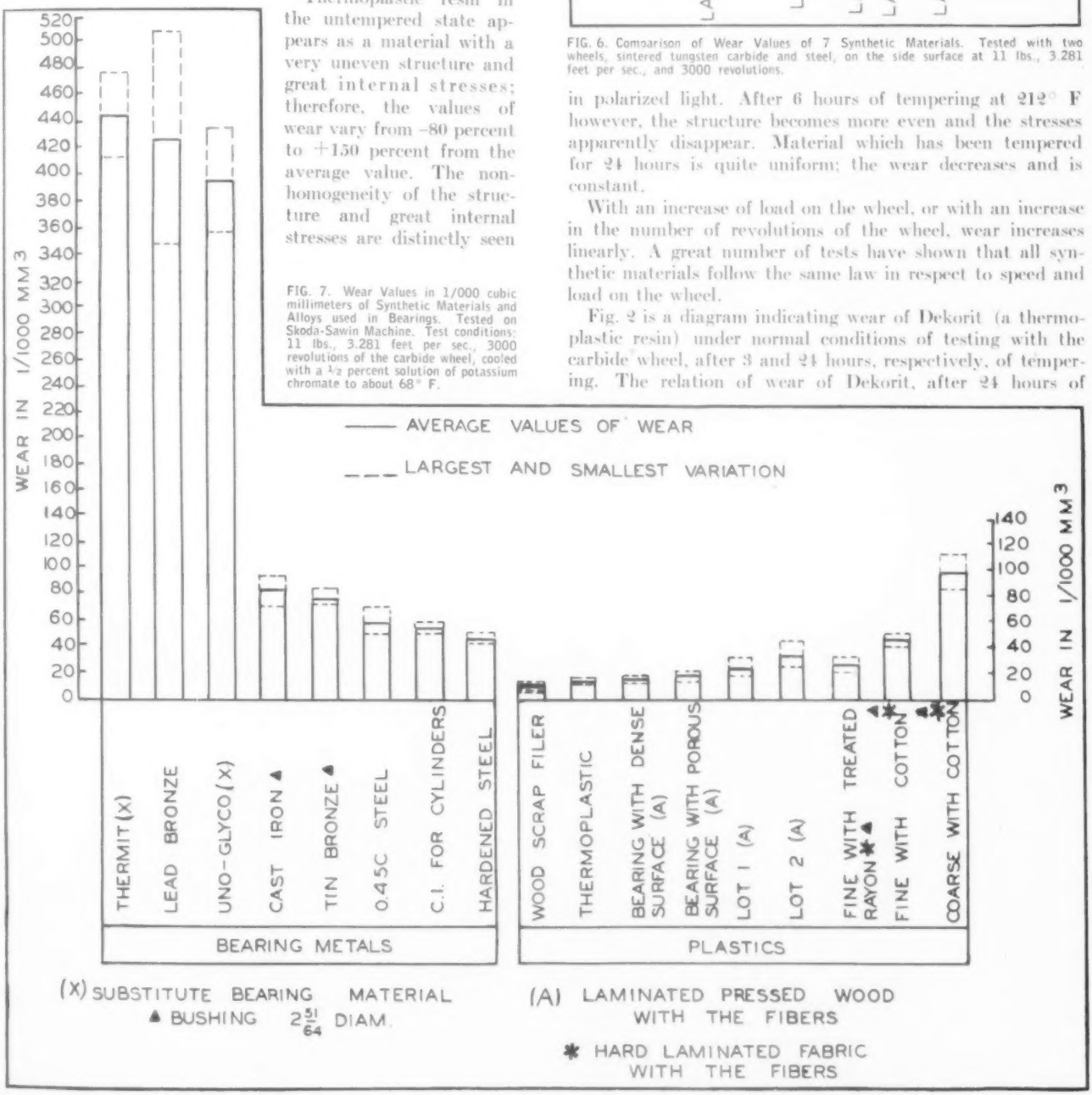


FIG. 7. Wear Values in 1/000 cubic millimeters of Synthetic Materials and Alloys used in Bearings. Tested on Skoda-Sawin Machine. Test conditions: 11 lbs., 3.281 feet per sec., 3000 revolutions of the carbide wheel, cooled with a ½ percent solution of potassium chromate to about 68° F.

tempering, to the number of revolutions, load, and speed is shown in Fig. 3. With an increase in speed of the wheel, from 0.82 to 6.56 feet per second, the wear decreases and attains its minimum values at a speed of 3.28 to 6.56 feet per second.

In synthetic materials made with layers of cloth, it is necessary to distinguish the resistance to wear in the top surface and at the side along the fibers, and also across them. The test of coarse laminated cloth material (see Fig. 4) has shown that its resistance to wear is ten times better on the side than on the top surface.

In Fig. 5 (left to right) are shown the test results of three types of bushings of laminated material. Bushing No. 3—a specially prepared rayon, highly homogeneous and resistant to wear—was tested with the carbide wheel as well as with a wheel of ordinary 0.60 percent carbon steel. The values of wear are nearly the same. Bushing No. 1 appears to be weaker. It was interesting to note that, when the same bushings were tested for several days on a special bearing test machine, and also in the shop for several weeks, the same results were obtained as in a laboratory test of only a few hours duration.

The wear resistance of laminated wood, consisting of layers of plywood, is approximately twice as much on the top surface as on the side surface. The resistance to wear of the so-called "woodscrap materials," made of small pieces of plywood, is the same on both the top and side surface. The scattering of individual values is less on the side surface. Therefore, the wear values on this side of the material may be considered as constant.

Investigation of different kinds of laminated wood, in regard to the condition of their manufacture, confirmed the fact that minimum wear occurs on the top surface of samples with a resin content from 15 to 20 percent made under a pressure of 1400 to 2100 lbs. per square inch. All samples pressed at a temperature of 320° F and a load of 4250 lbs. p.s.i. showed minimum wear regardless of the resin content.

The question is, now, whether or not the values of wear obtained with the carbide wheel have a practical significance for the synthetic materials. Is it possible to rely upon these values in day-to-day manufacturing operations when the synthetic materials are working in combination with materials of a hardness considerably less than that of carbide? As, for example, shafts of soft steel in bushings of synthetic materials?

A series of parallel tests was carried out to answer this question. Instead of a carbide wheel, a wheel of a steel such as is used for shafts was employed. The graph, Fig. 6, shows the comparative test results of seven kinds of synthetic materials when using a carbide wheel and one of steel. It is clear that the values of wear for both wheels are approximately the same; therefore, the carbide wheel can be considered as a reliable practical instrument for the wear determination of synthetic materials.

In Fig. 7 are plotted the results of wear tests with bearing metals and plastic materials, and here, the excellent wear properties of plastics show up.

Conclusions

The tests have shown that the powdered wear particles of the test bar act as the principal factor in the formation of the impression. While itself contributing very little, the carbide is a base or carrier for the wear particles; thus, the wear values obtained characterize the wear of a synthetic material by its own wear particles. The same phenomenon is observed when the carbide wheel is replaced by a steel wheel.

In practical applications—e.g., the work of a steel shaft in bearings of synthetic materials—the type of mechanical wear is of the same character as in a laboratory test. However, actual wear in the shop is much less, (1) because of a considerably lower unit pressure than during laboratory tests and, (2) because of lubrication since, in laboratory tests, only a coolant is used.

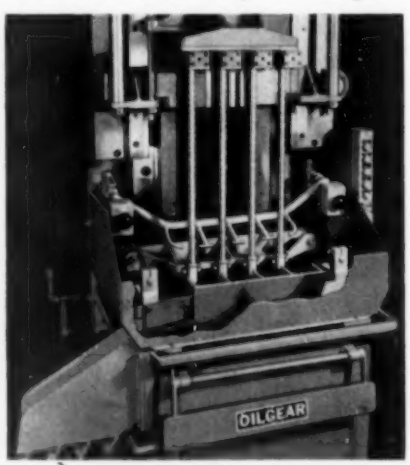
The tests show that (a) with increasing speed of the wheel up to 5 feet per second (1.5 meters per second) the wear of synthetic materials decreases and reaches its minimum value at that speed, and that (b) wear increases in direct proportion to increase of load on the wheel and also to increase in number of revolutions.

The same tests showed the most advantageous wear test conditions of synthetic materials, with the sintered carbide wheel, to be 11 lbs. (5 Kg.), 3.281 feet per second (1 meter per second), and 3000 revolutions of the wheel. This will give the designer a choice to obtain practical and reliable results. In such a case the speed is near the practical speed used in transmissions although the actual pressure of the bearings is exceeded many times.

This choice can be made because of the linear relationship between wear and load, and is advantageous in finding the values for wear in a relatively short period of time. It is obvious that, for the practical application of the test results, the laboratory test set-up for synthetic materials may be similar to shop conditions, but that the tests would require excessive time.

Cost Cutting With Multiple Broaching

As an example of savings to be effected by broaching, three splines, each .290″ wide x .123″ deep x 2″ long are being broached in each of four S.A.E. 1112 steel bicycle coaster brake hub shells, in one pass and at the rate of 630 pieces per hour. The machine used is an Oilgear Type "XP-30 x 54" Stroke Vertical Pull-Down Broaching Machine.



The operation is typical of pull-down broaching in that tools are secured at both ends during the major portion of the cutting stroke. Thus, possible sagging or bending of tool is precluded as a result of broaching in a vertical plane. Furthermore, there is continuous and presssure lubrication of tools and parts during the broaching operation, and chips fall quickly away from tools and cutting zone.

Handling is reduced to a minimum inasmuch as the operator merely locates the parts roughly in the fixture and depresses the two start buttons. The descending tools, which are pulled downward through the shells, automatically center the parts. Of interest, here, is the automatic ejection of parts after broaching. The shells are ejected into separate troughs, lined with rubber to prevent marring and equipped with separate guides for quick roll-out. Chutes, extending from left side of machine are connected to the customers conveyor system so that parts are carried away automatically. After broaching, the tools return to loading position automatically.

by **John G. Floden**

18-60000

The Effect of Cutting Fluids on Drilling Thrust and Torque

An investigation of the action of coolants in conjunction with cutting speeds and feeds

MOST PREVIOUS INVESTIGATIONS of cutting fluids have been limited to the comparison of fluids which are used commercially. The results of these tests have shown which cutting fluids are most effective under the conditions of each test, but they give little fundamental information about the action of these fluids.

In this investigation, a few fluids representing a wide range of effectiveness were used in order to accentuate the influence of the fluid on the cutting process. Several of the fluids used in these tests are limited to laboratory use because of their cost, toxicity, or inflammability. It is hoped that continued study of the effects of cutting fluids may lead to a better understanding of the cutting process, which is necessary if tools are to be designed for the most efficient removal of metal.

After careful study of the several drilling dynamometers which have been described in the literature it was decided that load measuring elements utilizing resistance strain gages would yield a unit of the required sensitivity and simplicity. The load measuring elements were designed in the form of thin-wall rings in order to eliminate changes in the zero setting, with changes in ambient temperature as discussed in reference (1).

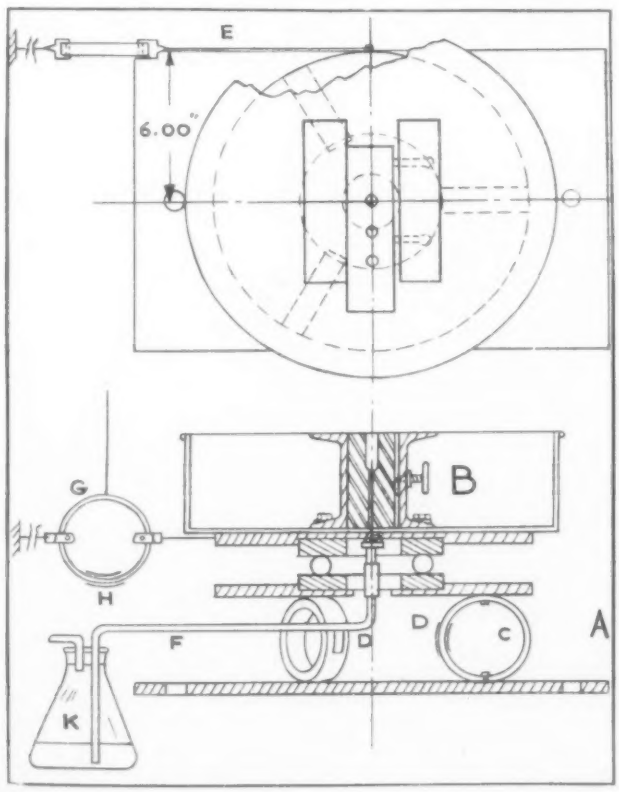
John G. Floden **is a native of Rockford, Ill., where he was graduated from high school. Entering the Mass. Inst. of Technology in 1940, he subsequently served in the Army, then, in '46 reentered M. I. T., where he is now completing his engineering course. He is a former member of the M. I. T. crew (wearer of T) and member of Tau Beta Pi.**

Apparatus

The dynamometer (Fig. 1) consists of two parts, a fixed base *A*, and a vise, *B*, mounted above the base on a ball thrust bearing. The base consists of two plates separated by three steel rings, *C*, to which wire resistance strain gages *D* are attached to measure the thrust load. The vise was restrained from rotating by a wire *E*, which was attached to a fourth ring *G* also fitted with strain gages *H* to measure the tension developed by the cutting torque in the wire. Ring *G* was supported by a string attached to a point several feet above it to prevent the weight of the ring from affecting the force readings.

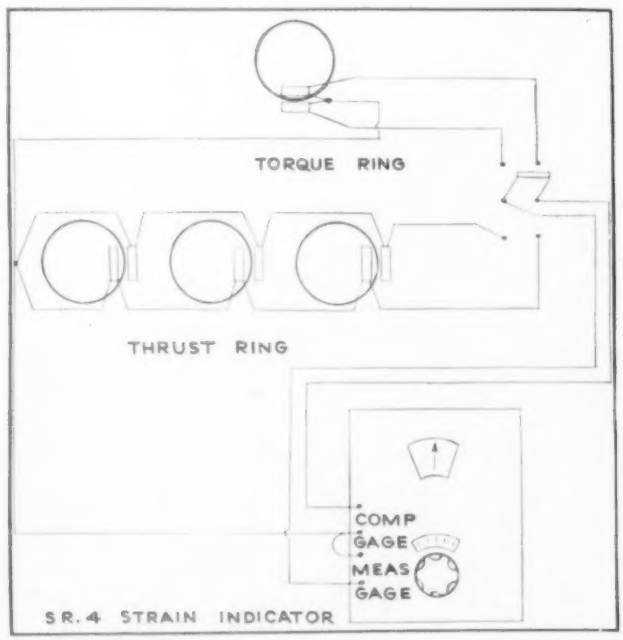
The wire strain gages, on all the rings, were placed back to back in such a manner that one was in tension and the other in compression. By the use of the tension and compression gages as two legs of the Wheatstone bridge circuit (Fig. 2), the need for a compensating gage was eliminated and the sensitivity doubled. The strain readings were made on a Baldwin-Southwark SR-4 Strain Indicator Box.

FIG. 1. The Dynamometer.



*This is a digest of a thesis submitted to the faculty of Massachusetts Institute of Technology in partial fulfillment of the requirements for the degree of Bachelor of Science in Mechanical Engineering. Because of the nature of the material in this thesis, and because of the value of the work which Mr. Floden has done, this paper was awarded the $100 prize offered by the Boston Chapter of the American Society of Tool Engineers. The purpose of this prize is to encourage young engineers in the field of Tool Engineering.

FIG. 2. Schematic wiring diagram for strain gages on force measuring rims.



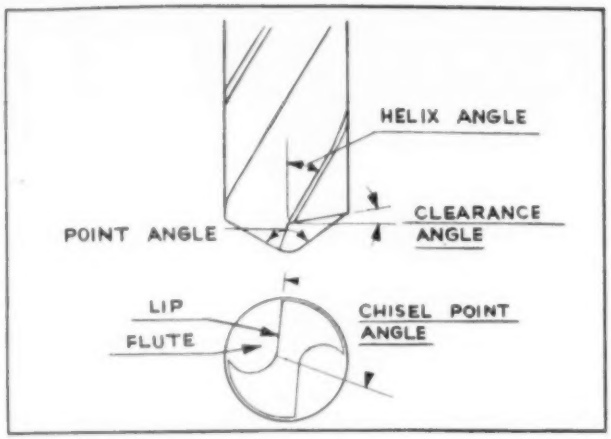


FIG. 3. Drill nomenclature.

The thrust measuring rings were calibrated by placing the dynamometer on a platform scale and applying vertical loads in increments of 50 pounds. In order to be certain that the load was vertical, with no moments present, it was applied through a ball bearing placed at the center of the plate to which the vise was attached. The ring used to measure the torque force was calibrated in a wire tensile testing machine. The vibration during drilling made thrust bearing friction negligible.

Test bars, of SAE 1020 HR steel and 2" x 4" in cross section and about 8" long, were drilled with a high speed steel drill, made by the Standard Twist Drill Company of Cleveland, Ohio. The drill, which was sharpened on a special drill grinder set to maintain original point and clearance angles, had a standard 31° helix angle, 118° (inclusive) point angle, and clearance angles of 8° at the periphery and 12° next to the chisel point. The web thickness was approximately .115". See Fig. 3. The drill press used was a 21" Cleereman, with speed and feed ranges from 40 to 800 RPM and .005" to .045" per revolution, respectively.

The cutting fluids used in this investigation are listed in Table I. The organic compounds were obtained from the Division of Chemical Laboratory Supplies of the Massachusetts Institute of Technology and were of commercially pure grade. The soluble oil G was one part by volume Esso #2175, containing sodium sulphonate, mixed with ten parts water. The cutting oil was Stuart Thredkut 99, a sulpho-chlorinated fatty oil.

Table I

Identity of Cutting Fluid Symbols

A Air (dry cutting)
B Benzene
C Water
D Methanol
E Carbontetrachloride
F Carbon Disulphide
G Soluble oil in Water 1:10 (Esso #2175, sulphonated oil)
H Commercial Cutting Oil (Stuart ThredKut 99, sulpho-chlorinated fatty oil)
J Soluble oil in Carbon Tetrachloride 1:10 (Esso #2175)

Procedure

Preliminary runs were first made to determine the best values of speed and feed to use, and to find a suitable method of supplying the cutting fluid at the drill point. There was very little change of cutting force with speed but, since vibration was smallest at 215 RPM, it was decided to run the tests at this speed. A feed of .009" per revolution was chosen because it gave a fairly heavy cut yet did not remove the metal so fast that there was insufficient time to take readings of the torque and thrust.

Because of the cost of some of the fluids used, and the necessity of keeping the fluid at the drill point at all times, it was decided to feed the fluid up through the work material. Tests made cutting dry showed that a 1/8" hole, offset 1/4", from the centerline of the drill had little effect on the cutting forces (Fig. 4). The fluid was fed by means of air pressure through this offset hole from flask *K* (Fig. 1) located beside the table of the drill press, so that each lip of the drill passed through the column of fluid once each revolution. Enough flow was maintained to keep the hole full and running over slightly during the drilling operation.

In order to determine the effect of the chisel point on the drill forces, a second set of tests was made with each fluid using a 1/8" pilot hole centered on the drill.

FIG. 4.

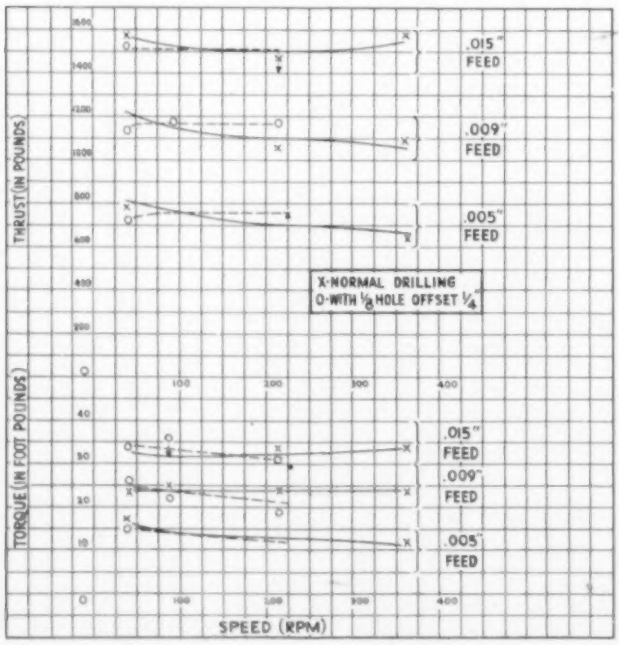
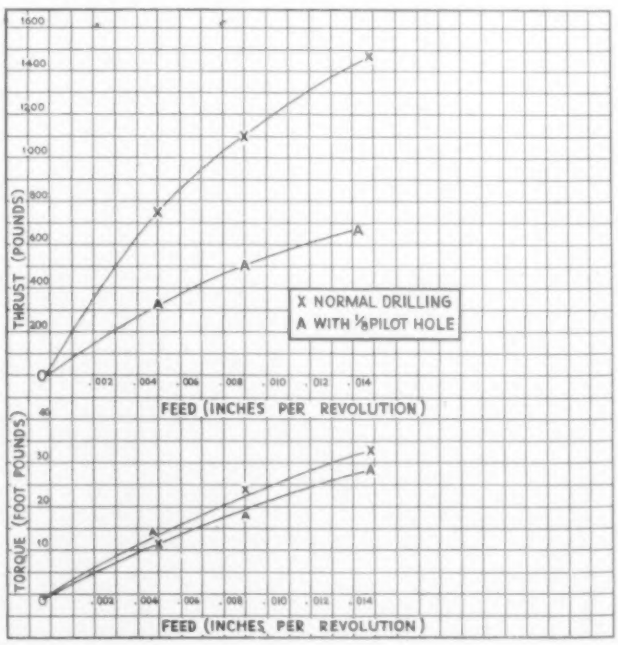


FIG. 5.



The extent of dulling of the drill was measured by making runs at 90 RPM and a feed of .009" per revolution, cutting dry, and also by a visual inspection of the cutting edge after each hole was completed. It was usually found necessary to sharpen the drill because of a chipped cutting edge before there was any noticeable change in forces due to dulling. Some difference was noted in both torque and thrust between individual sharpenings, the thrust varying from 1120 to 1185 pounds and the torque from 21 to 24 foot-pounds. These forces appeared to be extremely sensitive to small changes in the chisel point angle.

The average chip thickness was determined by measuring the thickness of the chip near the inside and outside edges, and averaging the two values. The thickness varied considerably over the width of the chip, so these measurements give only a rough approximation of the relative values of chip thickness.

Because of vibration of the drill press and dynamometer, the torque and thrust readings taken were average values with respect to time. The maximum amplitude of the torque variation during the tests, as measured by the deflection of the galvanometer needle, was about 2.5 foot-pounds, and that of the thrust variation was 30 pounds. For most runs these values were about half as large as these maximum values. Because of the variation of friction forces on the sides of the hole with hole depth, at least two readings were made at different depths.

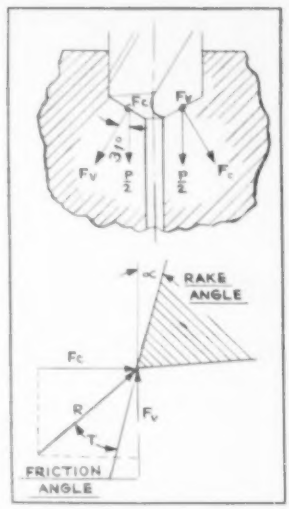
Results and Discussion

The torque and thrust were found to decrease slightly as the speed was increased from 40 to 360 RPM (Fig. 4). This decrease was smaller at higher rates of feed. The increase of torque, with increasing feed, was approximately the same as that found by other investigators (Ref. 2, 3), and the influence of a concentric $\frac{1}{8}$" diameter pilot hole upon the thrust and torque as shown in Fig. 5 are also in agreement with published data (Ref. 3).

The effect of the cutting fluids on the forces is shown in Fig. 6 (see Table I for identity of cutting fluid symbols used). The part of the thrust which is due to the chisel point was found to be nearly the same for all the fluids used.

For all fluids, it was observed that the material squeezed out ahead of the chisel point formed a built-up edge on the point which did the actual "cutting" in this region. The process is complicated by the fact that there is radial as well as tangential flow ahead of the cutting edge.

FIG. 7. Determination of equivalent normal and cutting forces for orthogonal cutting



Because of the small effect of the fluid at the chisel point, a study of the forces when drilling with a pilot hole better shows the effect of the cutting fluid on the cutting process. In order to study the forces, the thrust and torque were converted to equivalent forces acting at the midpoint of the lip (Fig. 7.) F_c is the force acting at the center of the lip in the direction of the normal to the plane generated by the cutting edge, and F_c is the force acting at this point which would give the same torque as that actually found. The variation of forces F_c and F_v with cutting fluid is shown in Fig. 8, the method of computing these forces being given in the appendix.

A study of these two forces shows that cutting fluids act in two separate ways, lowering the cutting forces by two distinct types of action. The first of these actions is that exhibited by carbon tetrachloride and carbon disulphide. These compounds reduce the force normal to the plane of cutting in a much greater proportion than the cutting force itself, changing the direction as well as the size of the resultant force on the tool point.

Since there was no evidence of any rubbing on the clearance face of the drill in any of the tests, this resultant force is the force the chip exerts on the tool face. Its direction is changed by decreasing the coefficient of friction between the chip and tool, probably by the formation of low shear strength compounds by chemical action (4) between the chip and fluid.

The chips obtained when drilling with these two fluids were much thinner than those obtained when drilling in air. They were tightly curled and very shiny on the face which had been in contact with the tool face, and the finish

FIG. 6

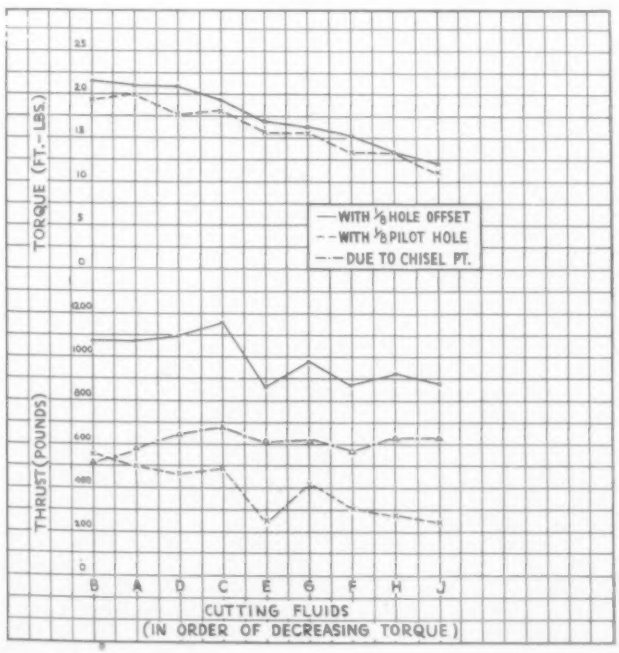
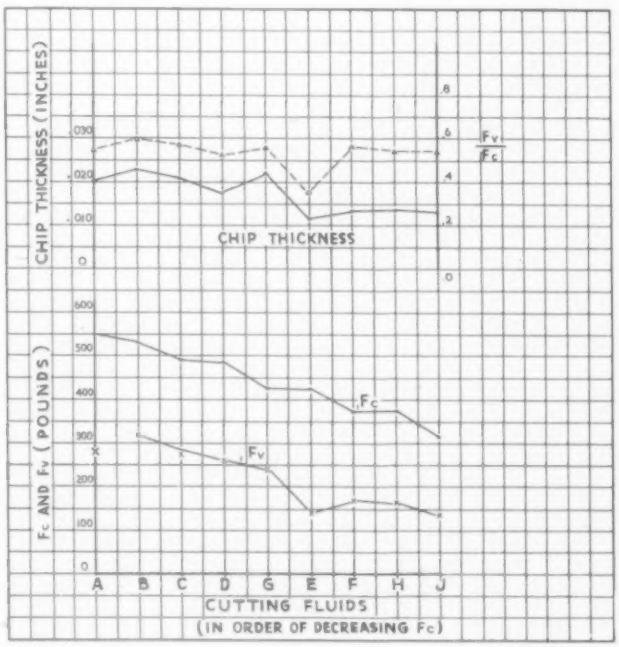

TORQUE (FT.-LBS.)
THRUST (POUNDS)
WITH 1/8 HOLE OFFSET
WITH 1/8 PILOT HOLE
DUE TO CHISEL PT.
B A D C E G F H J
CUTTING FLUIDS
(IN ORDER OF DECREASING TORQUE)

FIG. 8.



on the sides and bottom of the hole was very good. For each of these fluids a small built-up edge was found firmly attached to the drill lip after the operation was completed. This edge—about .005" thick and .010" high—was much smaller than that found when drilling in air and was more securely attached to the lip.

When drilling dry, the last chip was usually found attached to the cutting edge when the drill was removed from the hole. This chip could be knocked off easily and the built-up edge was found to be firmly attached to the chip. The tests did not indicate whether the complete elimination of the built-up edge would give even lower values of cutting forces. This point requires further study.

The second type of action is most clearly shown by the soluble oil *G*. This fluid reduced the vertical and cutting forces in about the same proportion. The resultant force on the tool edge was decreased considerably, but its direction remained the same, indicating that the coefficient of friction between the chip and drill cutting edge was approximately the same as that for the poorer fluids.

The reduction of the two forces may be due to decreases in friction between the drill margins and the sides of the hole and between the chip and the flute by viscous oil films. The chip thickness when using this cutting fluid was approximately the same as that found when drilling in air, and the face of the chip next to the tool was as rough as that found with the poorer cutting fluids. No built-up edge was observed, but the surface roughness indicated that there was one which was carried off with the last chip.

The tests made with cutting oil and with a mixture of one part, by volume, of soluble oil *G* in ten parts of carbon tetrachloride, showed a combination of the two effects described above. In the latter case the chips were about the same thickness and the thrust was the same as with the carbon tetrachloride alone, but the torque was reduced considerably. There was no evidence of any built-up edge. These fluids which combined the two types of action gave the lowest cutting forces of any of the fluids tried, and both gave an excellent finish on the hole sides and bottom.

The curves of chip thickness and F_v/F_c in Fig. 8 indicate that the chip thickness is closely related to the ratio of the forces. It can be seen from Fig. 7 that the ratio of the forces is a measure of the friction angle plus the constant rake angle.

Summary of Results

A satisfactory drilling dynamometer of unusual simplicity has been constructed using resistance strain gages as the force measuring elements.

Preliminary investigations made to determine the best speed and feed to use for the tests with cutting fluids, and for comparison with the results of other investigators, showed a slight decrease in thrust for an increase in speed from 40 to 360 RPM when drilling SAE 1020 steel, in air, with a $\frac{3}{4}$" high speed steel drill. At a speed of 215 RPM, the torque was found to be approximately proportional to the 0.8 power of the feed, while the thrust was roughly proportional to the 0.6 power of the feed. The investigations of earlier workers showed similar relations.

An investigation of the cutting forces, using both organic compounds and commercial cutting fluids, indicated little change in that portion of the total thrust force which was due to the chisel point when drilling with any of the fluids. The cutting fluid appeared to reduce the remaining forces on the drill point in two different manners, first, by reducing the thrust forces without an appreciable reduction of the forces in the direction of cutting, and second, by reducing both the torque and thrust in about the same proportion.

The reduction of thrust in the first case is believed to be due to chemical action between the fluid and the chip, forming low shear strength metallic salts, which act as "anti-weld" agents or solid lubricants. When fluids which gave this action were used, the chip thickness for a given depth of cut was found to be considerably less than when drilling in air.

The second type of action, which reduces both forces without much change in the coefficient of friction at the cutting edge, is believed to be due to boundary lubrication at the drill margins and between the chip and flute by the mineral and fatty oils in the cutting fluids. The chip thickness in this case was about the same as for dry cutting. Cutting fluids which combine the two actions described above were found to give the maximum effectiveness, both by reducing the cutting forces and by giving the best surface finish.

The scope of the investigation, reported here, was naturally limited by the time available for carrying out this project. Consequently, some of the observations and interpretations which have been given require further research. It is hoped that this investigation will be continued and that this progress report is accepted in the spirit in which it is offered.

Appendix

Calculation of Equivalent Cutting and Normal Forces

In order to determine the equivalent forces F_c and F_v it was assumed that: (1) the forces exerted by the chip on the drill point are uniformly distributed along the lip; (2) the mean rake angle α is equal to one-half the helix angle, and that (3) the mean radius $r_m = \frac{d_{drill} + d_{pilot\ hole}}{4}$

For these tests: $\alpha = \frac{31°}{2} = 15.5°$

$$r_m = \frac{.750 + .125}{4} = 0.219 \text{ inches}$$

From Fig. 7, it can be shown that: $F_v = \frac{P}{2 \cos 31°}$ where P is the thrust in pounds, and

$F_c = \frac{12\ T}{2 r_m}$, where T is the torque in foot-pounds, and r_m the mean radius in inches.

For example, when drilling in air, where the thrust was found to be 495 pounds and the torque 20 foot-pounds,

$F_v = \frac{495}{2 \cos 31°} = 289$ lbs. and $F_c = \frac{12 \times 20}{.4375} = 548$ lbs.

References

1. M. C. Shaw, C. D. Strang and O. W. Hart, "N.A.C.A. Study of Measurement of Piston-Ring Radial Pressure Distribution SAE Preprint", January, 1947.
2. R. Poliakoff and D. Smith, "Experiments Upon the Forces Acting on Twist Drills", *Proc. I M E, London* vol. 32, Pt 1 (1909), pp 739-830.
3. O. W. Boston and C. J. Oxford, "Performance of Cutting Fluids", *Trans A.S.M.E.*, vol. 54, no. 3 (15 Feb. 1932), MSP-54-2, pp 9-38.
4. M. C. Shaw, "Chemico-Physical Role of Cutting Fluid", *Metal Progress*, vol. 42, no. 1, July, 1942, pp 85-88.

The author wishes to acknowledge the cooperation of the machine tool laboratory of the Massachusetts Institute of Technology in making available the facilities used in this investigation. He further wishes to express his sincere gratitude to Professor Milton C. Shaw for the interest he took in this investigation, and for his invaluable comments and suggestions on the work.

It is also desired to extend thanks to the Bonded Oil Company, of Boston, and to the D. A. Stuart Oil Company, Ltd., of Chicago, who furnished the commercial oils used in these investigations.

By C. H. Bodner

Master Gaging for the Involute Curve

Optical projection, one of the simplest yet most accurate means of amplification, is used to check the involute profile

THE OLD SAYING that man's progress depends on, and advances with, his ability to measure, applies directly to the accurate reproduction of involute curves on spline and gear teeth. Since gears and splines are essential components of power transmission devices from watches to automobiles, it is evident that the involute is a very important curve. Therefore, the profile of this involute curve must be extremely accurate within practical limits. These practical limits are determined by our ability to measure the shape of the involute that our equipment generates.

C. H. Bodner **studied mechanical drawing and physics in Junior College, then, after gaining practical experience as apprentice, served two years with Vultee Aircraft, mainly in high cycle milling. For the next several years he was employed by Consolidated Vultee, first applying carbide tipped tools to high cycle and negative rake milling cutters, and later developing optical gaging applications as Standards Engineer. He is currently with Kennametal, Inc., Los Angeles, as service engineer.**

Many fine gages and measuring machines, in daily use, control the accuracy of the involute curve. Many of these use and depend on a master involute. But, how accurate is that master? How can we be positive that errors of generating did not creep into its making? In others, mechanical contacts and linkages of the amplifying mechanism have errors within their own tolerances of manufacture. Are these telling a true story when we use them? How long can any of these mechanical gages retain their accuracy before they start robbing from part tolerances?—and how many of these will check an internal involute curve as accurately as they do the mating external?

The following proposal is offered as one answer to some of these questions and as a supplement to present gaging methods. It consists of optical projection, one of the simplest means of amplification and, because of that simplicity, is one of the most accurate within its capacity for measuring or checking complicated contours. It is essential, on an involute profile, to know where and how much error exists in order to trace the cause of it in the tooling or setup, and to make corrections. Visual records of involute profiles may be obtained by simply photographing the projected image, as shown in the accompanying illustrations.

New Application of Old Principle

While optical projection is not new, the writer is not aware of any previous application such as described here for gaging the involute profile. It has aided greatly, for example, in solving Lockheed's problem of guaranteeing 100% interchangeability of mating spline members, such as used on the P-80, by making it possible to determine in advance by means of specimens whether new hobs and broaches could make parts that would mate with any made by original tools. When extremely close tolerances must be held on the pitch diameter on a 23-tooth spline, for example, there is not much room for tooth profile error or tooth spacing error since all teeth on a spline must mesh, whereas on a gear only three teeth mesh at any one time.

The chart gage, Fig. 1, was developed with the cooperation of Engineers Specialties Division, Universal Engraving and Colorplate Co., 1919 East 19th Street, Cleveland, Ohio. To simplify describing this proposal it is limited here to the Side Bearing Involute with 30° pressure angle, but can be applied to any involute profile whether straight or helical.

PROPOSAL: Recommended Pattern for Master Spline Chart Gages, Side Bearing Involute Splines 30° Pressure Angle, as per Fig. 1.

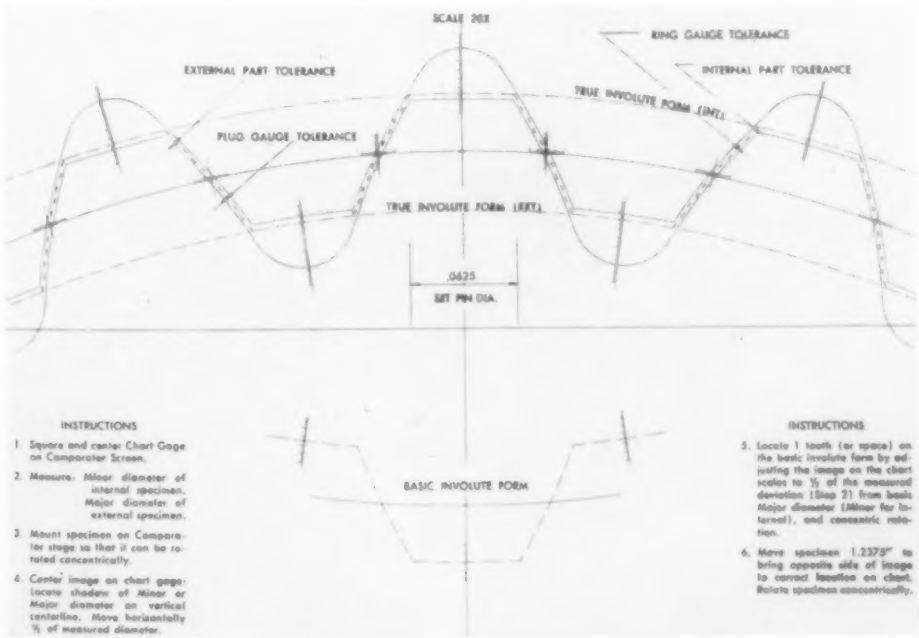

SCALE 20X
RING GAUGE TOLERANCE
EXTERNAL PART TOLERANCE
INTERNAL PART TOLERANCE
TRUE INVOLUTE FORM (INT.)
PLUG GAUGE TOLERANCE
TRUE INVOLUTE FORM (EXT.)
.0625
SET PIN DIA.
INSTRUCTIONS
1. Square and center Chart Gage on Comparator Screen.
2. Measure: Minor diameter of internal specimen. Major diameter of external specimen.
3. Mount specimen on Comparator stage so that it can be rotated concentrically.
4. Center image on chart gage: Locate shadow of Minor or Major diameter on vertical centerline. Move horizontally ½ of measured diameter.
BASIC INVOLUTE FORM
INSTRUCTIONS
5. Locate 1 tooth (or space) on the basic involute form by adjusting the image on the chart scales to ½ of the measured deviation (Step 2) from basic Major diameter (Minor for Internal), and concentric rotation.
6. Move specimen 1.2375" to bring opposite side of image to correct location on chart. Rotate specimen concentrically.

FIG. 1. Details of the Master Chart gage, as complete for this one spline size, i.e. 30° —2 angle; 16/32 pitch —23 tooth. Instructions for use are on the chart.

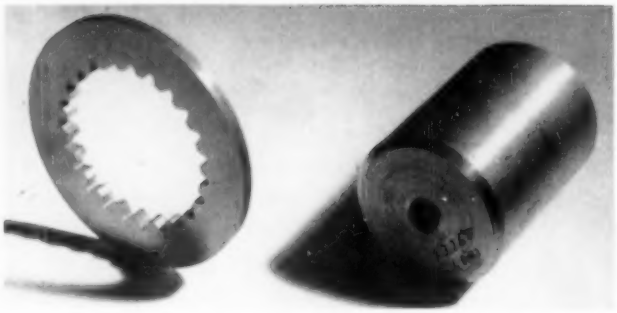


FIG. 2. This internal spline sample was used to check tooth form and circular pitch on a new broach prior to release for production. The plug was turned to fit the minor diameter and hold the sample on the comparator. Frequently a plug gage fits snug enough to be used for this purpose.

In order to properly appraise form of tooth and space as well as circular pitch, and their effect on other measurements of involute splines, it is recommended that Master Gaging of Involute Splines be performed on measuring optical comparators, or contour projectors, with dimensional substantiation by precision wire measurements, and such lead checking machines as may be depended upon to measure within the limits of designated gage tolerances.

Specifications for Master Chart Gages for this purpose:

1. Pattern: Chart Gage layout shall conform to the pattern in the attached illustration (Fig. 1) consisting of:
   a. Descriptive title.
   b. Vertical and horizontal centerlines.
   c. Plug gage tolerance.
   d. Ring gage tolerance.
   e. External part tolerance.
   f. Internal part tolerance.
   g. Minimum magnification for
      $^{32}/_{64}$ Pitch = 31.25 ×
      $^{16}/_{32}$ Pitch = 20 ×
      $^{8}/_{16}$ Pitch = 10 ×
   h. Instructions for use.
   i. Basic involute form.
   j. T.I.F. diameter (diameter at junction of involute form with fillet).
   k. Pin-check lines for .2625 dia. pin to check magnification.
   l. A minimum of 3 teeth (or spaces) shall be used to show tolerance.
2. Size: Chart layout shall be on glass to fit 14½" diameter optical comparator or projector. Larger diameter or rectangular glass may be used to suit individual requirements.
3. Magnification: Magnification shall be as noted in 1. Larger magnification may be used to suit individual requirements.

General

1. A separate chart is required for each spline size; the sample illustrated is for a $^{16}/_{32}$-pitch, 23-tooth spline; a separate chart gage is required for the 24-tooth spline with the same pitch.
2. Specimen:
   a. When inspecting a product by this method for profile and pitch, best results are obtained by using a specimen $^{1}/_{16}$ to $^{1}/_{8}$ thick, generated as a cross-sectional sample, of the same material, and produced by the same method as the product (See Fig. 2). The specimen should be produced by sandwiching between two additional blanks to eliminate burrs, prevent distortion and give clean, sharp edges. At least two specimens should be used for each check. This applies to broached, shaped or hobbed parts. If reflected light is used in projection, the specimen must have clean, sharp edges and should be polished to approximately 10 to 20 micro-inches RMS.
   b. If the part itself can be accommodated on the comparator stage, especially when using reflected light, specimens need not be used. Under such conditions a first part may be used as a master check of the tools or the set-up.
   c. An alternate method to using specimens is the use of casts made in any acceptable material for this purpose. Measurements on the comparator are limited to the extent of the casts.

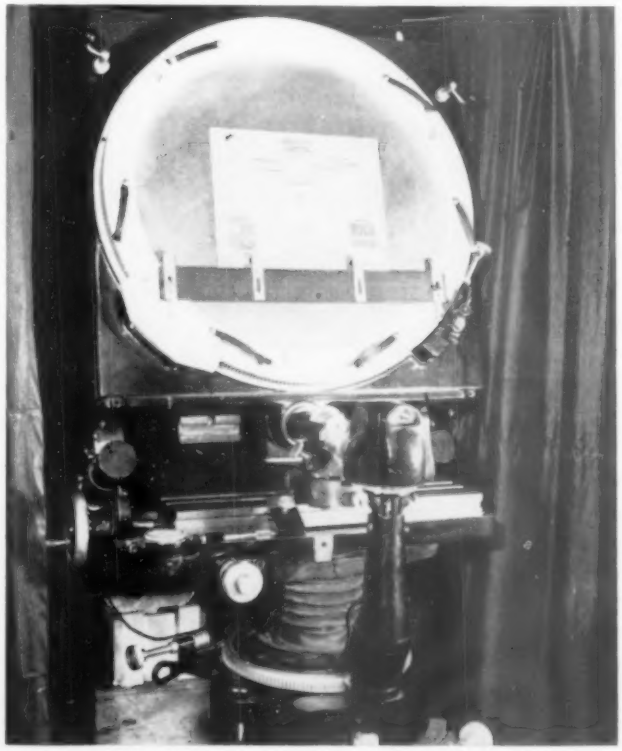
   Permanent records of the spline may be made with any of the above methods by simply photographing the image on the screen, as in the accompanying illustrations.
3. This chart gage (Fig. 1) will check the following items and elements:

Item	Element				
	Profile	Circular Pitch*	P.D.**	T.I.F. Dia.	Accumulated Circular Pitch***
Ring gage tolerance	X	X	X	X	X
Plug gage tolerance	X	X	X	X	X
External part tolerance	X	X	X	X	X
Internal part tolerance	X	X	X	X	X
Broach (by specimen)	X	X		X	X
Hob (by specimen)	X	X		X	X
Hob set-up (by specimen)	X	X		X	X

*Over three teeth in a single projection.
**Within the limits of the comparator used. Where tolerances are less than .0005", final substantiation may be made by precision wire measurements.
***Within the precision limits of the staging fixture or setup used. Where tolerances are less than .0005", final substantiation may be made by such lead checking machines as can guarantee the accuracy required.

4. Magnification: The recommended minimum magnification for each diametral pitch is for use on

FIG. 3. An over-all view of the comparator, showing how the chart is centered on the screen. Notice the dial indicator and micrometer spindle at the lower left of the comparator stage to check movement accurately.



optical comparators equipped with a 14½ diameter screen. Larger magnification may be used on larger machines provided a minimum of three teeth can be accommodated. (For convenience of the machine operator, a Mirror Image Overscreen type chart gage may be used rather than a replacement screen.)

5. Plug and Ring Gages: Due to their length these gages may best be checked by reflected light. To insure a clean sharp image that end of the plug near the handle, or one side of the ring gage may be left without chamfering. Wax impressions or casts in suitable materials should be used for maintenance inspection of the gage after it is in use.
6. Movement: If the optical comparator has only horizontal movement of the stage, or definite measuring limitations in vertical movement, the chart may be turned on end to accommodate the equipment.

Recommended Practice

Use of Chart Gages for Projection of Involute Splines.

Step 1. Select the chart gage with the pitch and number of teeth that correspond to the specimen to be checked. Install the chart gage on the comparator screen. See Fig. 3. Adjust the chart gage to align the center lines with those on the screen, or in relation to the rim of the screen holder. Check the magnification by projecting the image of an .0625 diameter wire between the pin-check lines on the chart. Check micrometers on machine by measuring a plug gage equal to the major diameter of the spline through complete travel of the plug diameter from the chart centerline as a reference point.

Step 2. Clean the part, specimen, or gage to be checked. Measure the minor diameter of the internal, or major diameter of the external. Compare with tolerance given for this spline dimension to find the amount of deviation from basic.

FIG. 4. The specimen mounted in a vee-block on the comparator stage. There is sufficient clearance to project the beam of light through the roof of the block, as well as over the top. The part can be rotated concentrically to check accumulated circular pitch.

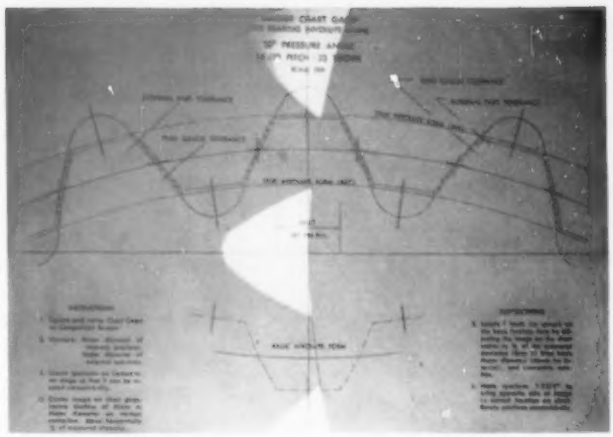


FIG. 5. The first step in centering the image on the chart. See instruction No. 4 at lower left corner of chart.

Step 3. Mount the item on the comparator stage so that it can be rotated concentrically. One simple method of doing this is to turn a short piece of drill rod, with a very light taper, to fit the I.D. of the internal item, or a short ring to fit the O.D. of the external item. See Fig. 4. These can then be mounted in a V-block. Focus the comparator to obtain a clean sharp image.

Step 4. To center the image of the item on the chart gage, move the stage until one side of the major or minor diameter is located tangent to the vertical centerline. See Fig. 4. With micrometer thimble

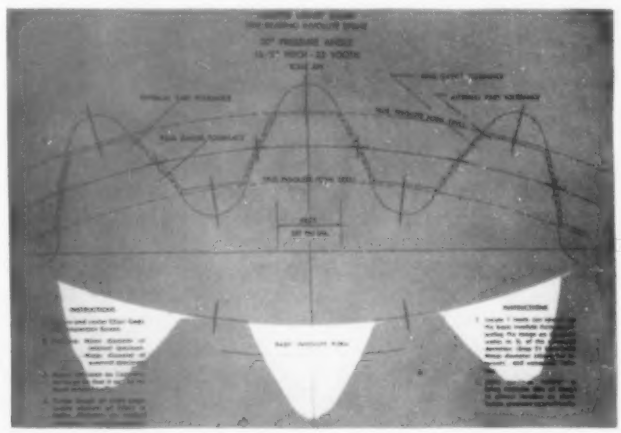
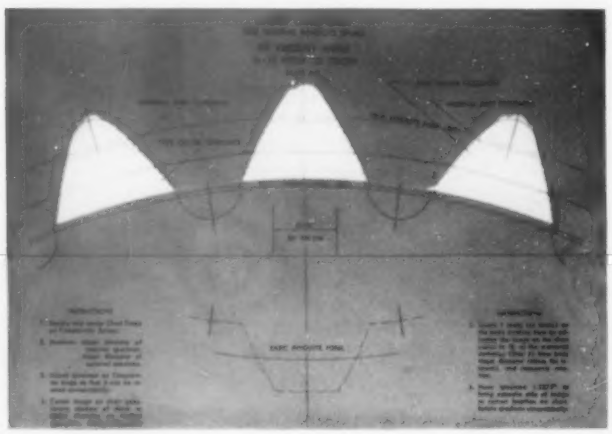


FIG. 6. The image positioned as per instruction No. 5 on the chart gage.

FIG. 7. Here, the opposite side of the image has been brought into position as per instruction No. 6 on the chart. Note that the shadow of the specimen falls below the internal part tolerance lines on the two outer teeth, indicating tooth spacing error, and checking the condition of the broach at the same time.



and dial indicator (or gage blocks), move the stage horizontally one-half of the measured major or minor diameter. (Step 2).

Step 5. Locate one tooth (or space) on the basic involute form by adjusting the image on scales of the basic involute form to one-half of the measured deviation, (Step 2) from basic major diameter (minor for internal). See Fig. 5. In the sample given ($^{16}/_{32}$-pitch, 23-tooth) the basic minor diameter is 1.3750" with tolerance taken plus to 1.3780". If the measured minor diameter in Step 2 comes to 1.3770" it would be .002" beyond basic. To locate accurately on the chart, move the image below the basic minor diameter line one-half of this measured deviation or .001". The scales on the basic involute form are in .001" increments at the magnification used. Rotate the specimen concentrically to center one tooth (or space) on the basic involute form.

Step 6. Move the stage vertically to bring the opposite side of the image to correct location on the chart. See Fig. 6. If the vertical lead screw and dial are not sufficiently accurate, gage blocks or micrometer thimbles may be used to measure this movement. For the sample ($^{16}/_{32}$-pitch, 23-tooth) this movement amounts to 1.2375". The image should then be between the appropriate tolerance lines on the top half of the chart gage. Check the circular pitch by use of the scales at the pitch line. To check accumulated pitch error, the item must be rotated 360°. Rotate the specimen concentrically to check accumulated circular pitch. Reflected light is best for this since a pencil mark on the tooth on the specimen shows on the chart gage and may be used as a starting point, and for each group of 3 teeth. Mark a tooth that appears at one extreme of the chart gage. Rotate this tooth to the opposite extreme and locate on the circular pitch scale at the same relative position. Continue until all teeth have been checked.

Conclusion

Like any new product or process the proposal described here needs further development to achieve ultimate results. For example, staging fixtures need to be developed that will simplify holding the specimen being inspected, especially so for helical gears, which must be rotated so that the light beam can be projected normal to the helix. Such further development, and general acceptance by application, can eventually result in adoption of this proposal as a national standard. This is our aim. The incentive is there in the form of lower over-all gaging costs.

Letters to the Editors

The Tool Engineer
Gentlemen:

I have been interested in gear design and manufacture for a considerable time . . . and have been collecting data, from miscellaneous sources, for a number of years. Recently, I was able to get copies of two installments of the . . . articles appearing in The Tool Engineer at the beginning of last year on "The Tools and Techniques for the Production of Precision Gears." As these are about the most informative articles I have yet seen I would like to get the remainder of the series. I should be pleased if you would let me know if copies of these articles . . . are available.

Yours truly,
S. M. Prout, Design Engineer
Control Apparatus Division,
Railway & Power Engineering
Corporation, Ltd., Toronto.

Mr. Prout's letter is typical of scores commenting on the value of these articles. Unfortunately, we have long since exhausted our supply of tear sheets—all but one set, which we are pleased to forward to Mr. Prout. In the future, we can only furnish photostat copies at cost.

The Editors.

The Tool Engineer
Gentlemen:

A friendly subscriber informed me that your magazine ran a series of articles on "Drawing Die Problems and Formulae," and I would like to know if it would be possible to secure all the back numbers bearing on this subject. Would appreciate having you advise the . . . subscription rate per year for The Tool Engineer, as I would like to subscribe.

Very truly yours,
T. S. Lockard, Operations Mgr.
The Keeley Stove Company.

We are pleased to forward the back numbers requested, of the articles by Mr. James Walker, which are in great demand. Subscription rate for The Tool Engineer, to non-members, is $6.00 per year in the United States, $6.50 in Canada and $8.00 in all foreign countries.

The Editors.

The Tool Engineer
Gentlemen:

In reading your July issue I noticed your sketch Fig. 1 of No. 12 installment of Fundamentals of Tool Engineering (Drilling and Boring Tools).

My idea on this pot chuck would be either (1) Put the two equalizers, Detail 12, in individual latches. In other words, instead of tightening nut 15 and then following up with two screws (Detail No. 10), you would merely throw over two gates each holding Detail 12 and tightening up two nuts (Detail No. 15) which are located on the end of the eye bolts.

(2) Merely place both equalizers (Detail No. 12) on another cross equalizer which would reach between the two parts. Then a man, by tightening one nut (Detail 15) would be able to clamp the part instead of one nut and then following through with the two square headed screws (Detail 10).

These are only my suggested ideas to make the fixture faster, what is your opinion?

Very truly yours,
H. Siedman, Master Mechanic
Morse Chain Company

While Mr. Siedman's suggestion is valid, and would work equally well, there are practical reasons for the design shown. The single latch is clamped down solidly against the body of the fixture and, because of the ball seat, cannot be readily loosened. Also, as the two equalizers are *inside* of the screws (Det. 13) there is no possible chance of rocking the part. That, however, would also hold true if a double latch were used.

While all this may be a matter of opinion, since either method would work, the fact remains that the fixture shown is a close duplicate of one that gave excellent service over a considerable period of time. Through an oversight in making up the art work, however, the two screws for the equalizers are shown square head. Actually, all screws should have the same size heads so that only one wrench need be used.

The Editors.

By **James Walker**

34-92000

Steels and Lubricants for High Production Dies

Metals and lubricants are both essential materials in the successful manufacture of drawn shapes.

Installment No. 8 of a Series on Drawing Die Problems and Formulae

UP TO THIS TIME, comparatively little has been said concerning dies for high production runs that exceed quantities of 50,000 (as for automobile, radio, stove and refrigerator parts) as compared to average runs that, ordinarily, do not exceed quantities of 50,000. Since the average run of tool steel is not conducive to long die life, it becomes obvious that steels or alloys must be selected that will stand up under long runs without repetitive regrinds and reworks.

The cost of tool steel per pound should be ignored, especially for comparatively small dies, or for dies that are intended to produce exceedingly high quantities. The following steel recommendations are suggested for high production dies; however, it is not to be inferred that the types suggested are "curealls". Each must be used with discretion.

Graphite Steels

Graphitic steel (Timken) contains free graphite which imparts free machining qualities, high resistance to wear, and good frictional properties with less tendency for "pick-up" or "galling" than the average run of tool steel. Graphitic steel is remarkably free cutting, with the short chip and finish similar to cast iron; moreover, it is adaptable to forging and rolling and possesses high impact strength. It also hardens readily and safely—that is, certain grades—up to 62 Rockwell on the "C" scale.

There are other types of graphitic steels—such as Graph-Tung—which hardens to 69 Rockwell "C". As previously stated, however, one must sacrifice impact strength, and vice versa, to secure greater wear resistance. Used as a die material, the graphitic steels have great future possibilities and are particularly advantageous when applied to drawing dies. The pores act as traps for lubrication throughout the entire length of the die, thus presenting a more slippery surface than would be obtained with a highly polished, close grained steel.

Bethlehem "Lehigh H" Steel

This tool steel was developed for use in the severest service where non-deforming properties and resistance to abrasion are essential. It is an air hardening, high carbon, high chromium steel although, if greater wear resistance is desired, it can be oil hardened. However, this treatment will result in more distortion than if air hardened, and will also cause the steel to be somewhat sensitive to grinding stresses. When either oil quenched or air hardened, it develops a hard surface and a strong surface reinforcement, thus providing a long life service without undue mutilation.

Fig. 1 illustrates a typical example of the results that can be obtained by Lehigh H steel. The die shown blanked 1½ million pieces from 22-gage cold rolled steel sheet, with only 3 regrinds.

Meehanite

Castings provide a basic means of fabrication and, although designs and materials change and improve, their use for industrial tools and dies remains fundamental. Meehanite, which is a trade name for a cast iron that contains 21 alloying elements and which is available in several grades for specific jobs, provides remarkable economies in fabrication.

Intricate shapes may be cast in, often requiring only grinding or "washing out" with portable tools to produce the finished die—that is, in addition to other necessary machine work and fitting.

All large forming dies should be cast, thus saving considerable expense in machining and lightening.

It is practical to request castings with alloys that make flame-hardening possible. Flame-hardening is accomplished by directing an oxyacetylene flame against the surface to be hardened. Rapid cooling (usually water) follows the flame immediately after heating, and the zone of maximum surface hardness thus obtained is usually one-half to three-quarters of the total depth of the case. It is file hard.

Important points to consider when ordering castings are: 1. Extra foundry stock, desirable on light castings to take care of warpage and cleanup. 2. Because difficulty, and also extra cost, is experienced when holes are desired, specify all holes—that is, if necessary—to be countersunk and the distance between the outside edge of the hole and the edge of the casting to be ½" minimum. 3. Avoid designs that involve sudden changes of heavy to light sections. 4. Use fillets with generous radii. 5. Wall sections and ribs, adjoining a hardened surface, should not be less than one-half inch thick.

Ampco Bronze for Draw Die Components

There is an increasing demand for articles fabricated from such materials as stainless steel, pure nickel, and monel metal, largely because of the beauty of the finished product. However, they are troublesome to "get going". Stainless steel, for one, is temperamental and partially responsible for galling, scratching, buckling and other attendant evils incidental to drawing operations.

For fabricating economy, the subsequent polishing, smoothing, pickup, and other rework operations must be kept to a minimum. While there is a variety of good tool steels available for the average run of dies, most of these steels will fail when drawing great quantities of stainless steel articles. It seems to make no particular difference what kind of tool steels are used, or how well the tools are polished; in a comparatively short time, stainless steel will tend to mar the drawing surfaces.

Most of the attendant evils can be overcome by applying a hard bronze to the drawing surfaces, sufficiently hard to resist wear, maintain form and accuracy for high production, and to decrease the reworking time. After considerable research, Ampco Metal Inc. developed an aluminum bronze which has additional properties not found in ordinary bronze. At the present time, there are available two Ampco bronzes —namely, Grade 21 and Grade 22—fully capable of producing excellent articles drawn from stainless, nickel and monel. If the production run is comparatively great, grade

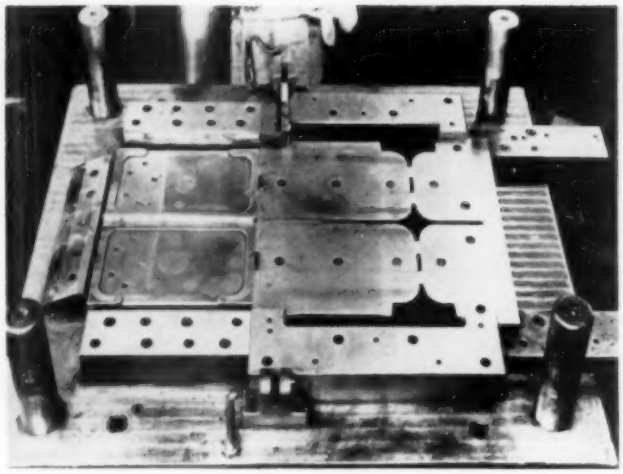


FIG. 1

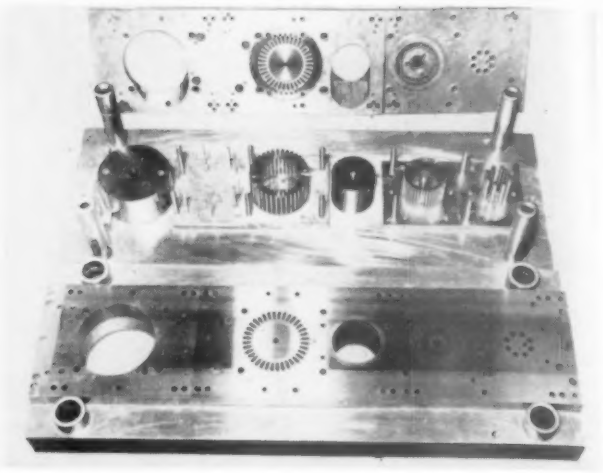


FIG. 4

22 is recommended; if the quantity and operation is less severe, grade 21 is recommended.

Being the softer of the two, grade 21 will naturally machine somewhat easier and quicker than grade 22, but will not provide the service life of the latter. An important consideration is that bronze dies will not deteriorate nor rust in open weather; therefore, when storage facilities are not available, the tools can be stored in the open.

For those intending to use Ampco, certain machining precautions must be observed. Because the metal is hard and brittle, do not take too heavy a roughing cut. Also, when planing or shaping, do not run out over either of the trailing edges since the metal tends to chip at these points. The best procedure is to start from each leading edge and work toward the center—that is, for the roughing cut. For the finishing cut, it is satisfactory to feed across the entire surface at higher speeds and finer feeds.

Holddown Pressure

The best material is centrifugally cast bronze, which can be obtained when the shape of the die is cylindrical. Irregular shapes, squares, rectangulars will have to be sand cast. Also, if the die is irregular or of intricate contour, the casting may be made sufficiently close so that the finish dimensions will merely require grinding and polishing.

It will also be found practical to keep the draw radius of the die as small as the job will permit, as too large a radius tends to veer the material, requires more power to form it and tends to buckle the drawn article. The smaller radius requires less power to draw the material over the drawing edge, thus die wear is reduced considerably.

Because the coefficient of friction of bronze is quite different from that of ferrous materials, all surfaces that contact the blank should be made from the same material. If the die were constructed from steel and the blankholder from bronze, a decided jump, producing wrinkles, would result because of the difference in the coefficient of friction. Also, because the coefficient of friction is lower, holddown pressure must be somewhat greater than is required for ferrous material. As for "break-in" lubricant, successful results can be obtained with the use of lime water, mixed to the consistency of coffee cream and applied to the first 20 blanks. This will start the operation; after that, the usual lubricant may be employed.

Bulging Dies

One way of producing a bulged article is to first blank and draw a cup. In some cases—see Fig. 2—it will be found more economical to succeed the cupping operation with polishing and buffing, as suggested by the article at right on the die, shown prior to bulging. The bulging die is obviously split and spring-loaded in order to remove the article after bulging. Note the very sturdy construction of the die, of vital importance due to the tremendous pressure that builds up in bulging dies whether fluid or rubber actuated.

The other components are the "heel" or wedge that forces the die to close, and the rubber punch. The length and diameter of the latter is determined by trial and error, and it is always practical to start with small diameters and work upwards rather than to use too large a quantity and have an accident. Fig. 3 shows the action of the heel as the press descends.

FIG. 2

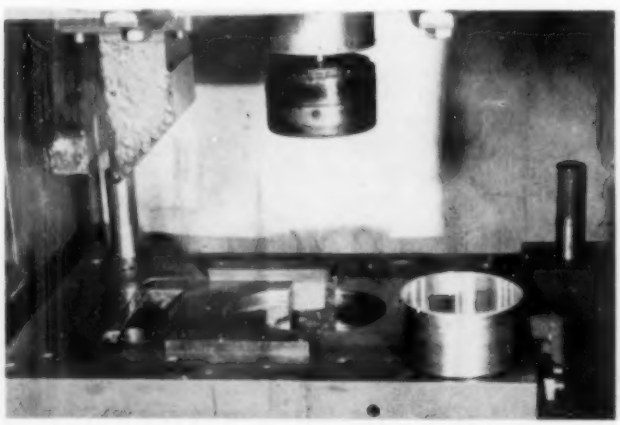
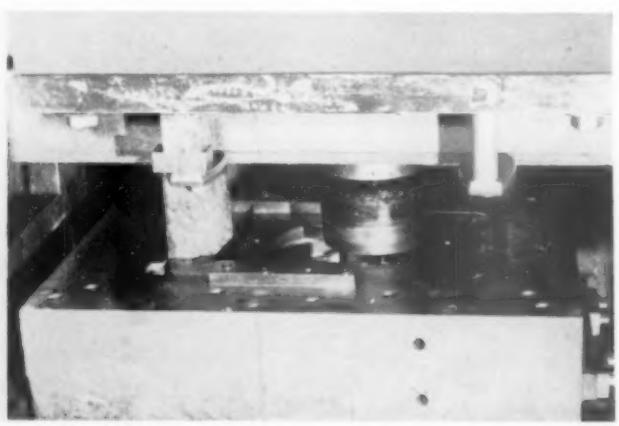


FIG. 3



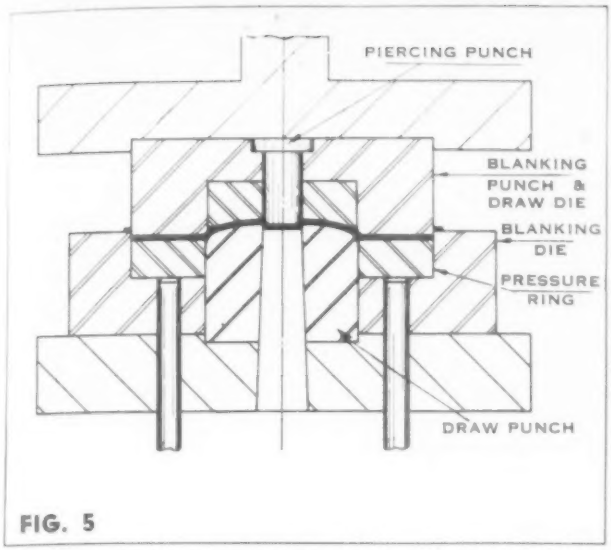


Fig. 5. 1st operation—blank, punch and shallow draw.

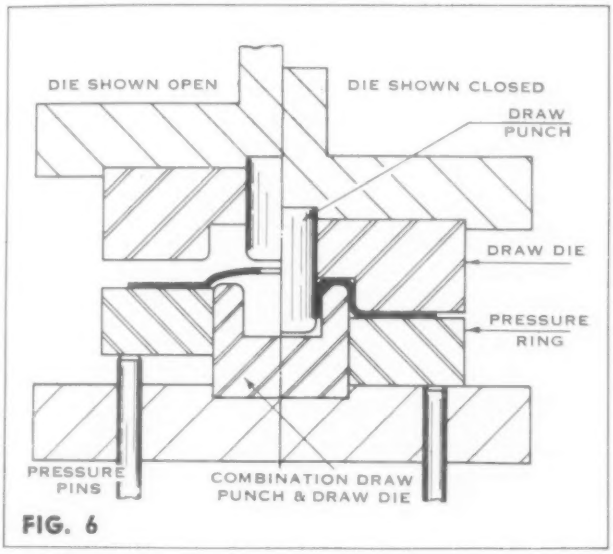


Fig. 6. 2nd operation.

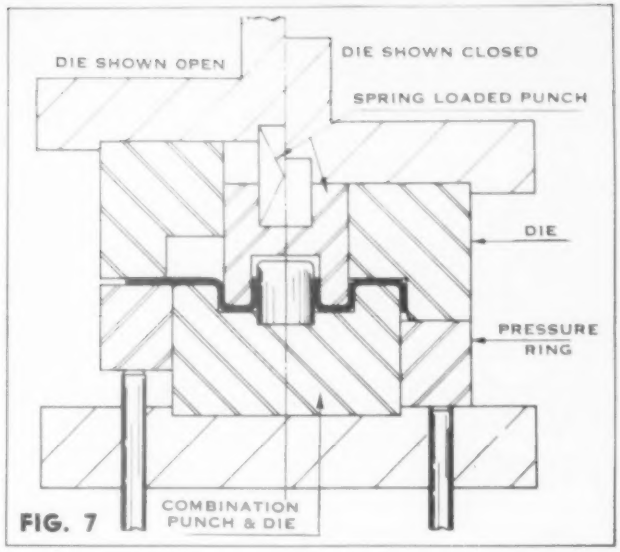


Fig. 7. 3rd operation.

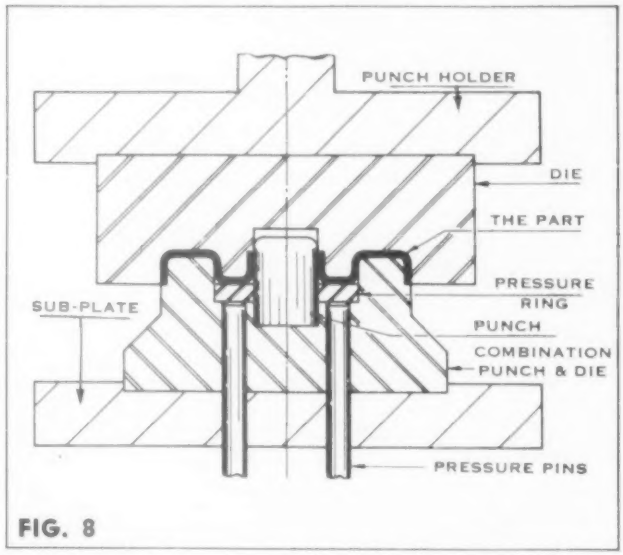


Fig. 8. 4th operation. Drawings by courtesy of Verson All-Steel Press Company.

Chromium Plating and Its Application

Chromium has a slippery surface which not only permits it to slide freely against other metals or other materials, but prevents solids and liquids from adhering to it. By reducing friction and wear, minimum heat is generated throughout the drawing operation. The combination of its hardness, low coefficient of friction and non-galling characteristics account for the use of chromium plating for large quantities of forming and drawing dies. It has been found that it not only increases die life, but improves the finish of the product. Data, compiled by United Chromium, shows the effects on the service life of chromium plated dies for various operations, and are as follows:

	Unplated	Plated
Blanking and Drawing Stainless Steel	500 pieces	20,000 pieces
Drawing	4,000 draws	75,000 draws
Forging a tube thimble	9,000 pieces	23,000 pieces
Ring for coining die	200,000 pieces	600,000 pieces
Swedging rivets	3,000 pieces	24,000 pieces
Swedging wire	4 an hour	52 an hour

Much consideration should be given to the steel base before chromium plating. It is significant that although chromium plate has a higher hardness than the average hardened steel, care must be exercised in selecting the steel base to prevent "cave in". It is not economical to chromium plate a soft steel, or a steel that might crack under impact loads. While chromium plating is expensive, its cost will be absorbed in a short period when adapted for high production runs.

One point to remember is that a smooth burnished surface be given the tool steel both prior to and after heat treatment preceding chromium plating. The cost of the additional time involved in providing a mirror finish will be well repaid.

Cromovan

Cromovan is a trade name of a high carbon, high chrome tool steel, manufactured by Firth Sterling Steel Company, that is becoming increasingly popular.

Fig. 4 illustrates a Cromovan six-station, progressive lamination die, for which an increase of 100% in production over former dies was claimed. The run per grind was 100,000 pieces. The die punches both rotor and stator laminations complete from .025 silicon lamination sheet. All cutting surfaces are made from cromovan, and clearance between punch and die equals .007" to a side. This die, which was built by the Hydro-Cam Engineering Company, Hazel Park, Michigan, is easily a masterpiece of die making.

The designs shown in Figs. 5, 6, 7 and 8 are examples of Cromovan die construction with a .003" chromium plating to insure a tough base-hard wearing surface for high production.

Fig. 5 illustrates the construction design of the blank, pierce and shallow draw die; Fig. 6 the construction of the second operation die; Fig. 7 the construction of the third operation die, and Fig. 8 the construction of the fourth operation die. The fifth operation is not shown; however, it is similar to Fig. 8 and it is merely a restrike die to set all radii.

Nitriding

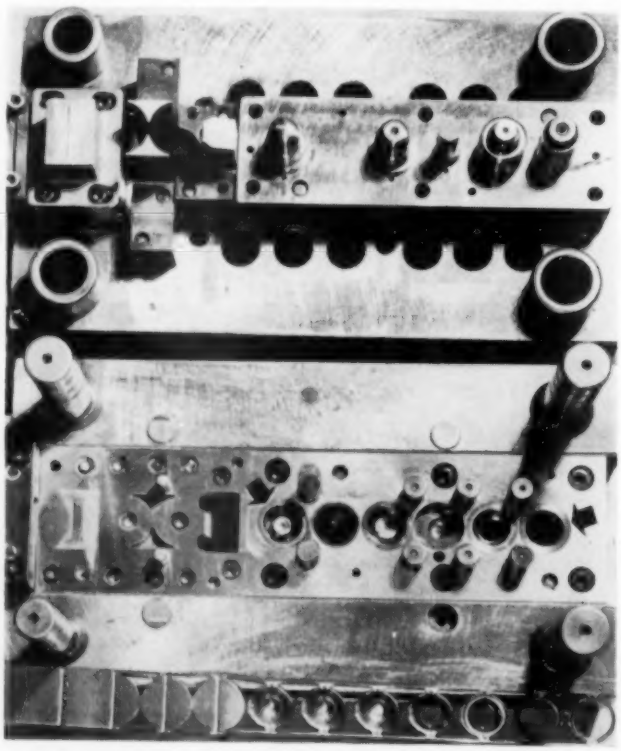
Wear in dies, resulting from galling, seizing, fouling and scoring, entail either continual replacement of component parts or a high wear resistant metal. To reduce wear, new and special metals, and processes to increase surface hardening of many metals have been invented. A comparatively new process—namely "nitriding"—is now gaining wide recognition. In 1926, new types of steels, especially adaptable to nitriding and sold under the trade name of Nitralloy, were introduced by the Nitroloy Corporation.

The principal advantages of nitriding steels are: (1) A remarkably high surface hardness, obtained without subsequent heat treatment; (2) this hardness is maintained after heating to temperatures as high as 1100° F; (3) the wear resistance of the nitrided surface is exceptionally high; and (4) the tendency to seize or gall is low. Nitrided parts neither warp nor distort to any appreciable extent, provided the internal stresses resulting from the machining and heat treating are removed before nitriding.

Nitralloy steels are usually purchased in the heat treated condition, especially so whenever the tools are to be machined directly from bar stock. It is not necessary to use heat treated stock when forgings are to be made, since they have to be heat treated after forging to refine the grain structure and to make them machinable.

A sufficient amount of the surface stock must be removed to eliminate all traces of decarbonization; otherwise, the

Fig. 9. A 9-stage progressive cut-out and cupping die with cemented carbide insets, indicated by arrows. The carbide insets add immeasurably to die life and provide the further advantage of quick and easy replacement in the event of possible damage. Photo by courtesy of Carboloy Company, Inc., Detroit.



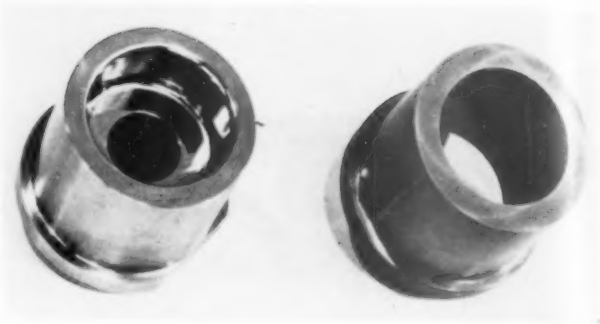


Fig. 10. Typical Carboloy die insets, of the type shown in the die, Fig. 9. Photo by courtesy of Carboloy Company, Inc., Detroit.

case produced by nitriding will be very brittle at the surface and will tend to spall. It is worth mentioning, however, that stress relieving (reheating to 1100° to 1300°) should be done in order to relieve the stressed portions of the steel due to "hogging" (rough-machining) the material. Obviously, stress relief precedes the final machining or grinding.

Graphite Nitralloy

A new development is a nitriding steel which contains free graphite. By a preliminary heat treatment (quenching from 1650° F. and tempering at 1375° F. for five hours) approximately two-thirds of the total carbon is converted to free graphite. Thus, the structure consists of about .8% graphitic carbon uniformly distributed through a matrix of carbon and ferrite. When such a structure is nitrided, a typical case is produced, except that the metallic structure contains pores filled with loose graphite. The soft graphitic phase seems to have lubricating properties of its own, further aids in providing oil reservoirs for maintaining a lubricating film, while the hard nitrides surface provides maximum wear resistance.

Carbide Dies

The rapid increase in cemented carbides for cutting tools has been so spectacular, during the past few years, that it has tended to eclipse the more gradual but equally important growth in use of carbides for dies. Not only have carbide dies become standard equipment in the drawing of round wire and for drawing tubes, bar stock and shapes, but many are now being used for the deep drawing of sheet metal.

The latter development is relatively recent, however. Until about 1940, the largest carbide die for deep drawing was only about 4" I.D., while today, there are in regular service carbide dies for deep drawing with I.D.'s as large as 13½". Since carbide nibs of this size weigh more than 100 pounds, a special technique for their production has had to be developed. One such is the "hot press" method in which the three major operations of pressing, semi-sintering, and sintering are combined in a single operation, with the final die nib having the same close tolerances and high surface finish as the smaller sheet metal dies.

The War Program greatly accelerated the use of carbide dies—in fact, their use was a major factor in obtaining and maintaining high production rates on numerous war items such as cartridge cases, both brass and steel. As a result, a wider variety of shapes, and also a greater variety of metals, are now being drawn through carbide dies than in pre-war days. For example, they are now being used in the manufacture of kitchen ware and other household utensils—particularly coffee pots, small and large funnels, and pressure cookers. Metals now being drawn on carbides include the plain carbon steels; special alloy steels; stainless steels; brasses; bronzes; copper; aluminum alloys; zinc alloys; lead; and tin.

Experiences of users indicate that the carbide dies have (1) an appreciably longer service life than comparable steel dies; (2) cut down the amount of servicing required; (3) appreciably step up production; and, (4) give a better surface finish to the metal, thereby often reducing subsequent buffing time. In addition, with carbide dies, the total number of drawing operations is less, thus also reducing the total die inventory of a plant. Decreased down-time of equipment for maintenance and servicing is another consideration.

Since, however, cemented carbide dies require highly specialized equipment for their manufacture, it is obvious that the average die shop is not equipped to make them. While a number of standard shapes, and many specials, are available from stock—as from Carboloy Company, Inc.—special shapes must be factory made, and to order. However, many standard shapes are available, as inserts, and these may be incorporated in dies that, ordinarily, would have steel inserts.

Lubrication of Dies—Reducing Friction

Reducing friction in press work, as in all other work where parts or bodies rub against each other, one has to contend with friction which, depending on conditions, will cause scoring, galling, tearing, or even under the most ideal conditions a certain power loss. Galling, as one of these results, is caused by frictional pressures which produce heat resulting in fusion and welding, followed by tearing of the frictional surfaces as they move apart. Galling may and often does occur on surfaces which have been lubricated.

When one surface slides over another in the presence of a lubricant, two different types of lubrication may exist. The first of these is thick-film or hydrodynamic lubrication. In this form of lubrication, the oil film separating the two surfaces is thick enough to obey the ordinary laws of hydrodynamics. Second, lubricated surfaces to which the ordinary laws of hydrodynamics do not apply are said to have boundary lubrication.

If the load and speed of rubbing on a given surface are kept within certain limits, and the viscosity of the lubricant is not too low, the two surfaces will remain separated by the film of lubricant. Lubricating oil is composed of tiny globules, comparable to the balls in anti-friction bearings (see Figs. 11 and 12) which, like the balls, are subject to breakdown under severe loads or continued service.

Viscosity and Boundary Lubrication

Viscosity is the term which describes the resistance of the flow of liquids—it is a measure of relative fluidity, usually expressed by the time in seconds required for a given quantity of oil to flow out of a standard orifice at a given head and at a given temperature. When the sliding surfaces move, the oil film will be sheared, and the important characteristic of the lubricant under this condition is its viscosity.

When the load, speed and viscosity are such that the oil film is too thin to separate the two frictional faces, the high spots begin to touch one another, and hydraulic lubrication no longer prevails. The condition of lubrication now existing is called partial-boundary lubrication. If we increase the load or decrease the speed, more of the high spots come in contact and the force required to drag the sliding member over the stationary one increases. Eventually we reach a stage where neither speed nor viscosity plays a major role, and a transition is made from partial-boundary to boundary lubrication.

Information has recently been brought to light on the nature and behavior of the surfaces of matter and lubricants. Some of the facts have been assembled to show how they aid us in understanding the means employed to reduce wear.

The surface tensions of mineral, vegetable and animal oils are not greatly different: These oils are, however, different to the extent, that the vegetable and animal oils have the peculiar property of adhering strongly to metallic surfaces, and are not easily squeezed out from between such surfaces. It has long been known that certain oils of vegetable or animal origin possess greater "oiliness" or "body" and are therefore effective in reducing friction under certain conditions.

Drawing Compounds

As in the case of steel, the worth of a drawing compound is determined by its economical performance, and not in its cost per pound. The most important items to be considered when purchasing a drawing compound are, first, the quality of the work produced; second, the length of the die life; third, the amount of spoilage; fourth, the quantity produced in a given unit of time; and fifth, the quantity required per production unit. A low first-cost material may eventually prove to be the most costly.

In the selection of a proper compound, there are several matters that must be considered: press speed, the kind of materials the tools are constructed of, type of material to be drawn and, finally, the methods for cleaning and finishing the parts.

As an example, parts that require a vitreous enameled finish should have a compound which is non-pigmented, with a low unsaponifiable content, because inert constituents of some compounds enter the "pores" of the material during the drawing operation, and if such substances remain the high heat required of the baking ovens will produce defects in the finished part.

Rigid Specifications Required

Home-made compounds should be discouraged. Fortunately, most forming shops have turned to the more scientifically blended compounds whose properties are known, and whose content does not vary with the mixing of each new batch. Specifications for drawing compounds are very rigid, and the combining of ingredients must be done in such fashion as to make them capable of dilution in a neutral oil, or in water; or frequently in a combination of both.

A compound, to meet adequately the needs of modern production must, first, serve to aid severe drawing operations; second, be suitable for lesser draws through a higher dilution; and third, withstand processing anneal (if necessary) while on the work without damaging the surface, or withstand a spot torch anneal without gumming or causing blisters to the finish.

The preceding requirements pertain to the mechanical working standpoint only. In order that a drawing compound may comply with the needs above, it must possess certain inherent characteristics. These characteristics are regarded as a part of the specifications covering such compounds and include the following:

High film strength; oiliness or lubricity; good "wetting out;" non-corrosive quality; removability, and stability. Finally, it must be safe to use.

High Film Strength

A high film strength is necessary, particularly during "ironing" operations which cause frictional heat generated by the plastic deformation of the material. Where high pressures are necessary, there is a wiping action of the metals upon the dies, and special pigments added to the drawing compound help prevent metallic contact. Various types of mineral, vegetable, sperm and fish oils are treated with chlorine or sulphur, which increases the anti-welding property of the compound under high pressures.

Where pigmentation is not objectionable, talc or graphite, fullers earth, mica, soapstone, barytes, whiting, lithophone,

and so on, may be used to increase the film strength. The materials mentioned above tend to thicken the film, thus enabling greater pressure to be applied for a longer period before film rupture occurs. Graphite is an inert filler which acts as a solid lubricant and prevents metal-to-metal contact even after the fatty film has broken down.

Lubricity and Wetting Out

Oiliness, or lubricity, reduces the coefficient of friction between the die surfaces and the work. A condition approaching zero friction is not advantageous, however, since a certain amount of "drag" resisting the flow of the metal is essential on severe drawing operations. Without the drag, there would be no control over the flow of the metal as it is drawn. The coefficient of friction is established through the control of the degree of water solubility of a product and the amount of water it contains.

Animal fats add oiliness to a compound, and chlorine increases their effectiveness. Straight untreated oils are primarily lubricating agents and should not be considered as good drawing compounds.

Good wetting out properties are necessary to keep the surface tension low. Wetting out or surface activity is controlled by the correct proportioning of saponifiable and unsponifiable oil bodies. Good drawing compounds adhere to the work, and spread sufficiently to form a protective coating ahead of the working portion of the die. Good wetting out and oiliness, although equally essential at the bottom of the die, tends to be the poorest there; hence, a poor lubricant will fail completely to reach this point.

Non-Corrosive and Removable

The compound should be non-corrosive and free from mineral acids that might injure the material or the dies. Good drawing compounds have the power to penetrate the pores of the metal being drawn, and where these pores are momentarily enlarged through the slipping of the cleavage planes, the compound is forced still deeper into the work. It becomes even more important that corrosive materials should not be used, since the attack of such substances would be intergranular as well as from the surface. Examples of the above are the reactions of sulphur on copper alloys, or alkalies on zinc. Where there is a lapse of time between operations, or where the finished articles are stored, the compounds should provide a slushing film that has a rust inhibiting action.

Removal of the compound succeeding the drawing operations must be made easy. A practical method is the use of an alkaline tank and high pressure washing machines where inexpensive commercial materials of alkaline base are the cleansing media. If a commercial degreaser is employed, a chlorinated or hidrocarbon type of solvent may be used. The method of cleaning naturally depends upon the type of compound used. Compounds having a high soap content cannot be removed effectively in a degreaser, nor can a highly pigmented compound which would cause an accumulation of sludge in the degreaser tank be easily removed. Alkaline cleaners in washing machines are often preferred for the reasons aforementioned.

Mineral oils provide adhesion to the metal surfaces, but must be kept in proper proportion to facilitate removal with a caustic type cleanser. Excess mineral oil content requires a naphtha or benzine-type cleanser for thorough removal. For this reason, where an alkaline cleaner is used, mineral oils are combined with soda or potash-base or similar emulsifying agents for thorough removal.

The compound should be of such nature that the prescribed method for cleansing can be done immediately after fabrication, or after a few days of storage.

Uniformity, Stability and Safety

Each lot or drum of material must be consistent in uniformity and stability if satisfactory results are to be obtained. Resistance to separation or decomposition is a requisite, as is freedom from rancidity and changes due to variations in temperature and humidity. Chemical preservatives such as sodium fluoride, benzoic, or carbolic acid sometimes aid in preventing fermentation. Physical stability is an inherent characteristic, although largely dependent upon the care with which the drawing compound is blended.

All compounds should be free from harmful effects to the persons using them. To provide for this, the ingredients should be such that neither absorption by the skin or inhalation of their fumes will be injurious. It is essential also to give consideration to the reaction of the compound with the cleansing media, for it should not be expected that the compound can counteract the effect of strong alkaline solutions and solvents.

No perceptible nauseating odor should emanate from the compound, either while in use or while in storage. This in-

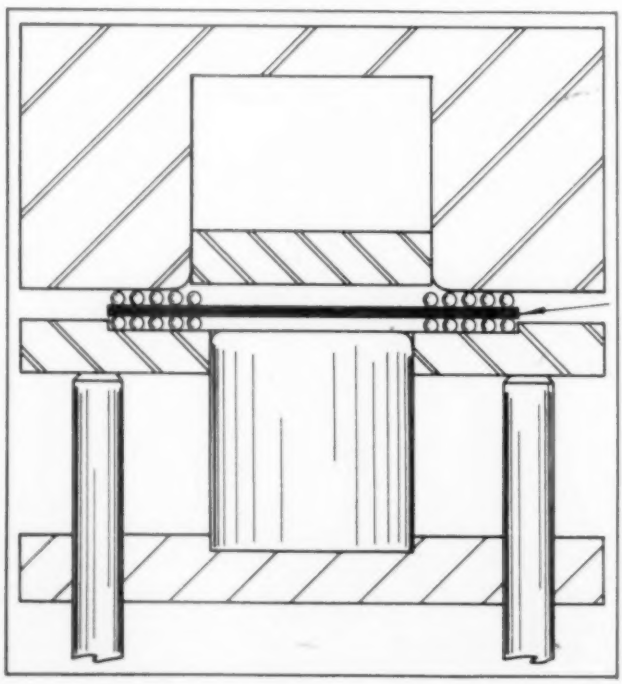
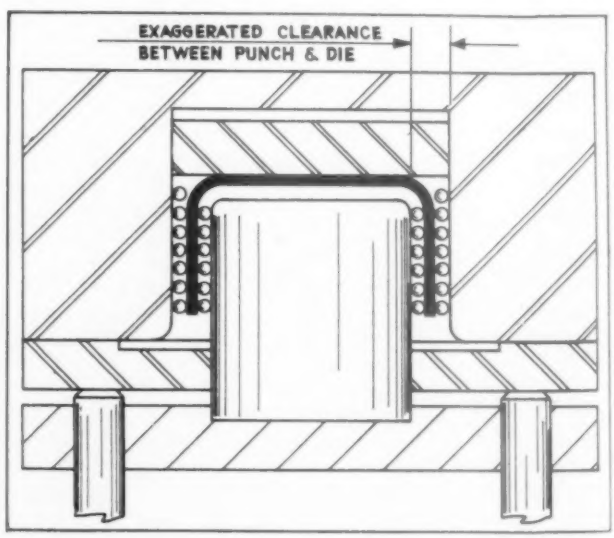


Fig. 11, at left, and Fig. 12, below, show how the tiny globules of the lubricant act as "balls" to reduce friction between the metal surfaces of the punch, blank and die in drawing operations.



gloves fumes caused by the heat of the process and rancidity resulting from bacterial action. Careful consideration should also be given to any "perfume" added for the purpose of deodorising the acrid or foul odors of various chemicals, as the odors of such ingredients may be equally harmful.

Mixing the Compound

The drawing compound should be easy to mix into the solution with either neutral oil or water as specified. The water in the drawing compound serves as an emulsifier and also as a binder between the mineral oils, animal oils, and soaps. Additional water is merely a diluent.

When dilutions are to be made, it is extremely important that a suitable diluent be used. In instances where a non-soluble or non-emulsifying concentrate is being used, valuable time and material will be wasted by any attempt to mix it with water. When such errors are made, failure to obtain a suitable compound is too often blamed on the concentrate. Before the mixing, the type of concentrate should be carefully checked as to its solubility in water or oil diluents, or a combination of both. Be sure the containers are clean.

When preparing compounds with a water mixture, it is desirable to use warm water. While not absolutely necessary, the use of warm water results in a more rapid mix, since less agitation is required before emulsion is formed. Warm water should be added in small quantities, under agitation, until the jell is broken and a smooth creamy consistency is obtained, after which warm water may be added more rapidly, until the final dilution is reached.

When preparing compounds with an oil mixture, oil should be added slowly while being agitated, plenty of time in agitation being allowed, in order to work the added oil into the compound. In every case where a concentrated compound is to be diluted both by oil and water, the oil should be added first. The initial procedure should be the same as when oil only is added. A gradual addition of the oil under agitation should be made until it is thoroughly mixed with the concentrate. The water is then added, slowly at first. This will cause the emulsion to thicken gradually until the saturation point is reached, after which it will thin out rapidly.

Applying the Drawing Compound

Various methods are used in applying the drawing compound to the work. A brush, rag, or swab is often used, particularly where a sufficient quantity can be applied in this manner; however, where excess quantities are necessary, this method would result in a waste of compound. The more modern methods include circulating systems, similar to those used in controlling the flow of cutting oils, where the compound is pumped in either a stream or spray on the work. In deep drawing operations an even flow of compound is not desirable, since the metal must be stretched more at some sections of the draw than at others, and an even dispersion of oil would complicate rather than simplify such a process.

Typical Drawing Compounds

The present deep draws of metal would not be possible were it not for the development of die lubricants. E. F. Houghton & Company, for one, has been responsible for progress made in drawing compounds. There are many other blanking and drawing compounds, available from reputable manufacturers. However, the three to be mentioned below have been successfully used by the writer and may be considered representative of quality lubricants required for high production press work. In any event, it would be well to consult the manufacturer, or his field agents, when confronted with press operations requiring blanking or drawing compounds.

Following is a brief description of three drawing compounds that many shops have found to be very satisfactory for the major portion of their production:

Houghto-draw 431 is a dark, heavy oil compound with an approximate viscosity of 250 and 210 degrees F., containing a high percentage of sulphur and E.P. (extreme pressure) treatment. This compound has proved most suitable for use in punching work. A single application of the compound swabbed on the punches adheres so well that several operations can be made before a further application is necessary. It is recommended for use in the punching of high or low carbon steel, when applied neat on the punch. When diluted with a light mineral oil, it is suitable for the piercing of high or low carbon steel. In this instance the entire surface of the work should be covered. The same dilution is suitable for the mild drawing or forming of low carbon steel. This compound should never be diluted with water. For removal, a degreaser, high pressure washing machine, or tank cleaner may be used.

Use of Rolls Recommended

Houghto-draw 453 is a heavy, dark "tacky" mineral oil compound which is E.P. treated, but not sulphurized. It was developed particularly for the drawing of aluminum alloys, including duralumin and alclad, tim-plate and most zinc work. For heavy-duty operations and deep drawing, best results are obtained by using neat form, but dilution with a light mineral or machine oil may be used for lighter work. This concentrate is not emulsifiable and should not be used in water dilution. It is important that a light, even film cover the work, and the use of rolls for applying the compound is recommended. Neither aluminum nor tim-plate will become discolored by the compound, even in storage, either in its neat form or diluted. Degreasing, high pressure washing, or tank cleaning may be used when the compound is to be removed.

Houghto-draw 756 is creamy white, heavily pigmented but without sulphur or E.P. treatment. It contains 30% colloidal pigment of exceptionally fine particle size. Developed especially for deep drawing of steels, including stainless, it is equally effective wherever heavy-duty operations require a pigmented compound. It was outstanding in its successful application in the drawing of steel booster magazines and steel cartridge shells during the war. It is soluble in oil, water, or both, and is effective in even higher dilutions than are generally used with other compounds. The solution works well in circulatory systems, without clogging or gumming. Because of the high percentage of pigment, alkaline cleaners in tanks or high pressure washing machines are recommended for removal of the compound.

Anti-Corrosive Finish

AN ANTI-CORROSIVE finish, known as Co-Polymer P-5, has been developed for the protection of metal, wood, and concrete against corrosion from moisture, acids, alkalies, and other disintegrating forces. P-5 is applicable for most industrial uses where a non-corrosive, fast-drying finish is needed.

P-5 is free from objectionable paint odors, is non-toxic, and dries by evaporation without requiring an oxidation period. It has good thermal stability, is highly resistant to abrasion, and possesses good aging characteristics. It does not oxidize or become brittle.

P-5 coating is available in nine colors. Complete information may be had from the manufacturer, The Watson-Standard Co., Pittsburgh 12, Pa.

by Robert Mawson

34-73100

A Quick-Acting, Positive Drill Jig

Simple design provides quick loading and unloading for small lot production runs

WHEN ANALYZING A WORKPIECE, for which jigs and fixtures have to be designed and made, an important consideration is the time element required to locate the part in the fixture and to remove it after machining. Being nonproductive time, it must be reduced to a minimum. When a special tool requires considerable time, in manipulation, it loses its efficiency as an element in cost-reduction equipment.

Some jigs and fixtures require so many motions, in order to locate, clamp and unload a workpiece, that the production cost is as high—or nearly as high—as if the operation had been performed without a special tool. Under these conditions, the only advantage which they possess is that they produce interchangeable parts. However, if we add to this advantage the feature of quick action, the tool then becomes a definite cost reducing medium.

Robert Mawson **is a registered Professional Engineer, engaged in industrial engineering, and located at 58 Stewart St., Providence, R.I.**

Fig. 1 shows a wheel axle bracket, and the machining operation we are concerned with is drilling and reaming the four ¼″ holes. Drilling and reaming the two 7/16″ holes, and the incidental spotfacing, is done in a previous operation. When drilling the ¼″ holes, it is important that they be at right angles to and symmetrical with the axis of the 7/16″ holes. To meet this requirement, a drill jig—Fig. 2*—was designed incorporating a positive locating device and, to make the tool more efficient, a quick acting principle was included in the design.

The jig is a semi-box type, open on two sides, with the bushings and hold-down screw contained in a screwed-on and dowelled bushing plate. There are four feet or "buttons," integral with the base casting. The bushing plate is cleared away, just in front of the hold-down screw, for finger room when loading and unloading.

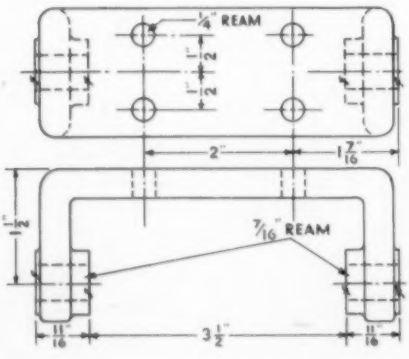
In loading, the part is temporarily rested on two machined pads, and slipped sideways onto the locating pin at extreme right. An opposed, mating locating pin is provided in the lever, shown at left. As the latter pin enters the 7/16″ hole, the part is lifted clear of the temporary rest pads by the lifting action of the bullet nosed pins. The part is then rolled back against the stop pin, shown directly behind the hold-down screw, which is then tightened.

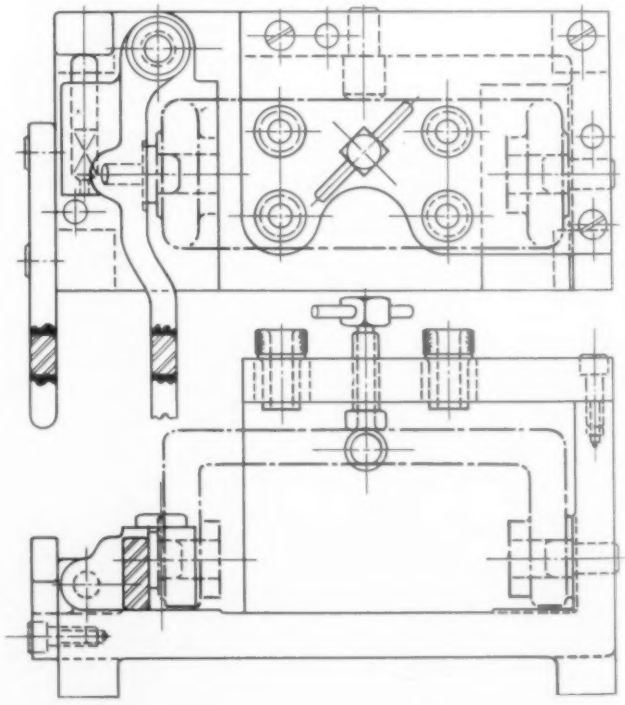
The ¼″ holes are first drilled, using slip bushings, which are then removed for free reaming, the reamer following the drilled holes. To unload, it is only necessary to loosen the thumb screw and retract the lever, when the part can be easily grasped between thumb and finger and unloaded.

While operating and construction principles should be obvious, a few explanatory notes may serve to clarify any mooted points. For one thing, there would be several ways —and some of them better—to design a quick acting fixture for the part shown. In this case, however, we are dealing with a comparatively simple drilling operation and with comparatively small lot production. Hence, a simple and inexpensive fixture is in order.

Note that the fulcrum of the lever is in line with the spotfaced end of the boss. That assures alignment of the two locating pins. Note also that the hold-down screw is off center, back toward the stop button. This insures that the part will bear against the stop when clamped. Note, further, the handle at left end; this provides a plier grip for operating the lever, which is restrained from excess forward motion by a stop pin. The washer on the end of the hold-down screw is to prevent "walking" when tightening.

As a final note, the lever is machined on the bottom and rests against the pad in the base; thus, there is solid support when tightening the hold-down screw. The lever is cast, preferably of steel or bronze. As it is the most expensive part of the jig, it should be made of unbreakable material. A vent hole is drilled in the plunger hole, for escape of air. Obviously, both locating pins, as well as the lever fulcrum pin, are of hardened and ground tool steel.





At left, the part—Fig. 1. The jig—Fig. 2 at right—is designed to drill and ream the four ¼" holes symmetrical from the center line of the two 7/16" holes. The open, simple construction provides for easy loading and unloading.

*Note: The original drawing, by Mr. Mawson, was somewhat modified, for purpose of reproduction, to eliminate confusing details. However, all principles incorporated in the original have been retained.

The Editors.

by Frank Zagar

34-12000

Accurate Broaching of Round Holes

The pros and cons of producing round, straight holes under adverse conditions

ONE OF THE MOST DIFFICULT, and yet one of the most common problems of broaching is that of sizing round holes, which are broached when it is desirable to maintain consistent size, within the matter of tenths in order to perform subsequent operations. When so broached, the parts are held on arbors or mandrels. Broaching round holes is also specified when fit is required, or when the holes are long and of small diameter, and it is impossible to obtain desired results either in size or finish by conventional boring or reaming methods. Broaching is a fast operation, comparatively speaking, and can be done at relatively low cost.

Frank Zagar **served his apprenticeship at White Motor Co., Cleveland, and studied mechanical engineering at Fenn College; later, he was variously employed as tool designer. In 1937, he joined his father, Wallis, in organizing Zagar Tool, Inc., Cleveland, Ohio, and assumed the dual position of Vice-President and General Manager.**

One of our earliest experiences, at Zagar Tool, was that of broaching a round hole in a bushing which was used in precision aircraft pumps. Speaking frankly, we failed miserably on that job, even though we spent weeks attempting to do it by broaching and burnishing. However, we did form some conclusions which, although not necessarily correct, most certainly can shape thought in applying broaching to other jobs.

On our initial attempt, the part was a bushing with a flange shoulder. Now, the usual concept in regard to broaching is that each part will be of like size, inasmuch as exactly the same diameter of tool has been drawn through it, and we had the idea that we could successfully broach to size by using burnishing rolls on the last few teeth of the broach. Burnishing teeth, however, have a tendency to spread the metal and since the metal directly opposite the flange of the bushing was considerably heavier in cross section, it therefore offered more resistance to the burnishing teeth than did the skirt end of the bushing.

Consequently, we found that the holes would consistently be one-half thousandth tighter near the flange than they were on the skirt. We then concluded that the burnishing of a round hole, in a part of a thin or irregular cross section, was not practical inasmuch as difference of wall thickness offered a variable resistance and caused deviations and fluctuations in size. When we used burnishing balls or burnishing teeth on parts made from stainless steel, ferrous metal, or any material which had a tendency to gall, the burnishing teeth quickly accumulated the metal and made the holes very ragged.

Our sum total experience with the burnishing idea on round holes inclines us to the belief that burnishing is a much abused and unpractical method of sizing, except on soft bearing materials, and we have therefore eliminated it from our consideration. Through sad experience, we no longer have any wish to even consider it.

We made other attempts at sizing round holes, with some limited degree of success, but never arrived at any final conclusion on the subject until we received a trial order to finish broach a great number of pieces with a relatively thin wall section, producing a $^{9}/_{16}$" diameter hole, 8" long. The part was a hydraulic cylinder, made of steel, requiring an extremely good finish and close size. (See Fig. 1), and the job was received in the form of a tubing which was rough reamed to within ten thousandths of finish. We spent about six months, experimenting, until we obtained results which satisfied our customer and gave us adequate production and broach life.

During this experience, we arrived at a number of conclusions which will be enumerated here. The following is entirely the results of our own experiences, and will not necessarily conform to established or traditional practices. We do not feel that we have the complete answer to the successful broaching of round holes.

Design—Length of Broach and Tooth Spacing

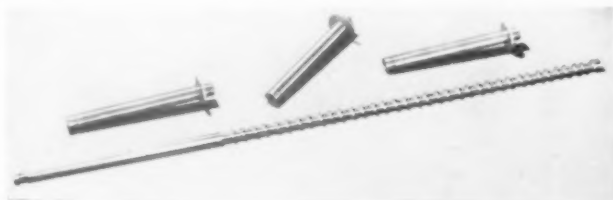
We first had to design the broach. There were the usual factors involved in the initial stages, as, for example, what length the broach should be, how many teeth it should have, what the spacing should be between the teeth, and what the teeth should cut from tooth to tooth.

The length of the broach is more or less determined by the length of stroke of the broaching machine which is available. We manufacture a broaching machine with a 20" stroke so, naturally, we put this job on one of our standard machines. We first tried one broach, with 12" of effective cutting teeth, the part itself being 8" long. See Fig. 2. We did not have much success with a short stroke, as it necessitated too much cut per tooth. There were so many teeth cutting at one time that the load on the cross section of the broach was too heavy, and the broaches had a tendency to snap off. We also obtained rough finishes, and were unable to maintain size.

We then made two passes with our short stroke machine, so that we had 24" of cutting teeth, instead of 12". This increased our production cost, as we had to add another operation. In the meantime, we designed and made a broaching machine with a 36" stroke, then designed a broach with 21" of effective cutting teeth shown in Fig. 3.

In 21" of effective cutting teeth, it would be possible to make the pitch $^{1}/_{4}$" and have 84 teeth, or, it would be possible

FIG. 1. Parts with long holes and thin walls are successfully broached to close tolerances.



to make the pitch 1", and have 21 teeth. We ended up by making some sample broaches which had 35 teeth and 49 teeth, respectively, in the length of 21". We did not feel that it would be safe to go under $\frac{3}{8}$" pitch, since there was some indication that a chip .0005" thick by 8" long would take up considerable space.

We knew also, from two previous experiences, that a broach with $\frac{1}{4}$" tooth spacing has considerably more drag or pull than a broach with $\frac{1}{2}$" spacing, as each tooth has a land which builds up a drag. Relative to the spacing between the teeth, it is advisable to stagger the spacing since, if regular patterns were spaced off exactly at $\frac{1}{2}$" intervals, there would be a tendency to set up a pulsation which would cause the broach to vibrate and show corresponding chatter marks in the part itself. The better practice is to vary the spacing—i.e., $\frac{3}{8}$", $\frac{7}{16}$", $\frac{1}{2}$", $\frac{9}{16}$", $\frac{1}{2}$", $\frac{7}{16}$", $\frac{3}{8}$", and so on, so as to minimize pulsation. See Fig. 3.

In broaching round holes, a balance must be established between the removal of stock and the number of teeth which are in the part at one time. We did not remove more than .001" of stock per tooth, and we removed that only on the first four teeth of the broach. In round holes, there is the condition wherein there are crosswise tool marks from the reamers or drills. This results in the first teeth of the broach producing chips which are broken—i.e., they are not continuous. It is thereby possible to broach a lot more stock per tooth on the first five teeth than it is on the last or finish teeth.

Cut Per Tooth and Tooth Root Diameter

In determining the amount of stock to remove, the writer would recommend that it never exceed .003" per tooth on the first teeth, and never more than one-half thousandth on the last teeth.

It is desirable to have the smallest possible root diameter, or as much hook as is practically possible per tooth. We found that our broaches would last a lot longer if we decreased the size of the root diameter from the beginning of the broach to the end. In this way, the broach had considerably more strength, during the heavy cutting of the first teeth, and had enough strength—and considerably more chip clearance—in the last teeth.

In the actual grinding of the broach, we ground the root diameter on our Landis center grinder and produced a smooth finish form, as is indicated on the drawing. *When we sharpen broaches, we make sure that we never touch the root diameter with the broach sharpening wheel.** If this diameter is nicked or scored with the broach sharpening wheel, it will introduce a weak point at that spot, and cause the broach to break more easily. Careful grinds on the root diameters produce smooth finishes so that chips will not pile up, and are easily removed from the broach.

We tried various methods of using chip breakers, including everything from none at all to a great number. We found that we had the most success in using a large number of chip breakers. At first, we did not use the chip breakers on the finishing teeth, but, after some experience, found that it was necessary to have them on all of the broaching teeth.

Chip Breakers and Lubricant

We arrived at a practical answer to the question concerning the relative merits of chip breakers. Material on a part being machined has a very specific and definite volume. When it is removed with a cutting tool, the chip has a greater volume or size, due to the breaking up of its particles, or the breaking up of the structure of the material.

In broaching without chip breakers, the chip is in a continuous round circle and, as it is being removed, swells sideways or against its perimeter as well as in a forward motion. This sideways pressure tends to make the chip buckle and dig into the parent metal, causing deep scores, chip clogging on the face of the broach tooth, and is even the initial cause of much broach breakage.

When chip breakers are introduced around the periphery of the tooth, they give the chips a chance to expand into the open spaces. For the length of 8", we found that we produced a perfect chip curl and that there was free cutting and no clogging. We obtained much better finishes, increased our broach life, and reduced broach breakage to practically zero.

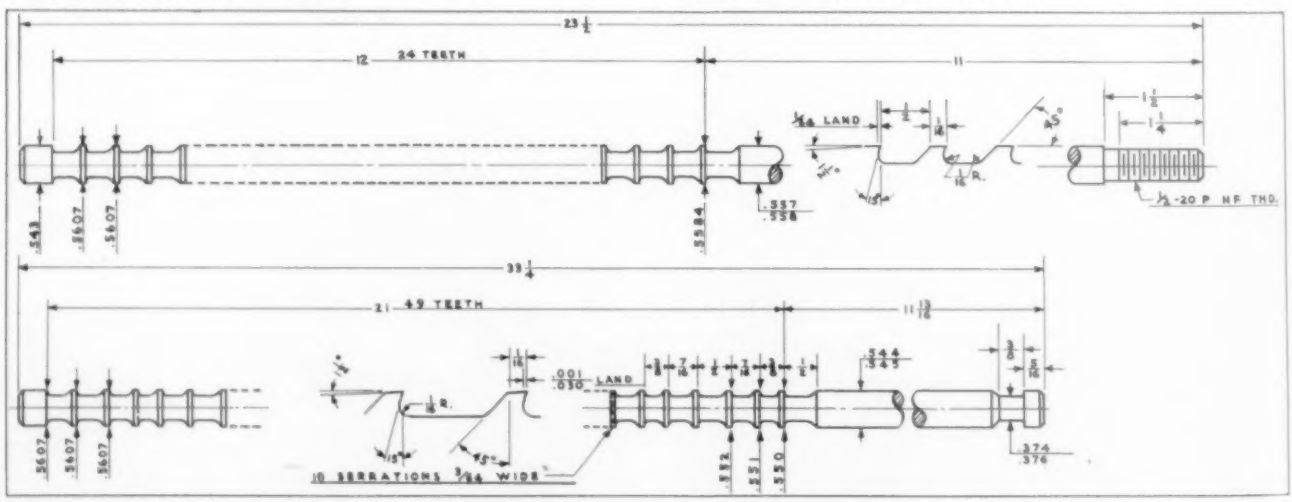
This one factor of using adequate chip breakers in the right places contributed more to our success on this job than did anything else, with the exception of ehtlubricant.

Concerning the lubricant, at our first attempt we used what is commercially sold as the best grade of broaching oil. This oil consisted of a black base oil, such as is used on threading or other severe machining operations. We had considerable difficulty with chips hanging on to, or sticking to the broach. We also had considerable difficulty with the galling. Finally, in desperation, we used what would normally be called the worst type of lubricant for a severe cutting operation—that is, a standard soluble solution, mixed about 40:1. We were pleasantly surprised at the result!

We made very good broached holes (Fig. 5) with no sticking of the chips on either the land or the face of the broach teeth. After some experimenting along this line, we have finally concluded that Simplex soluble oil, as prepared by the Cincinnati Milling Machine Company, is perhaps the best oil to use in a severe broaching operation.

*Common mistake in general practice—important.

FIG. 2, upper drawing. FIG. 3, lower drawing.



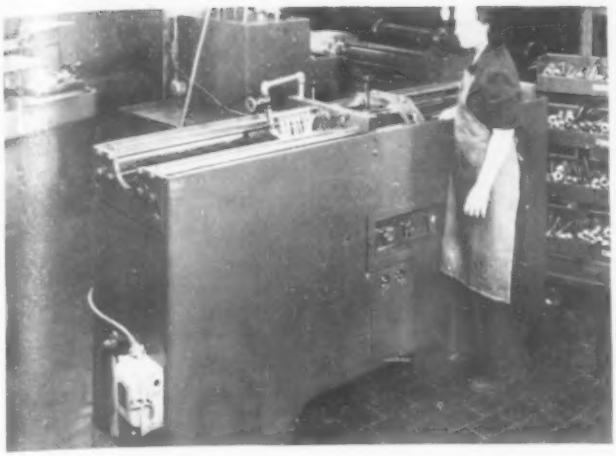


FIG. 4.

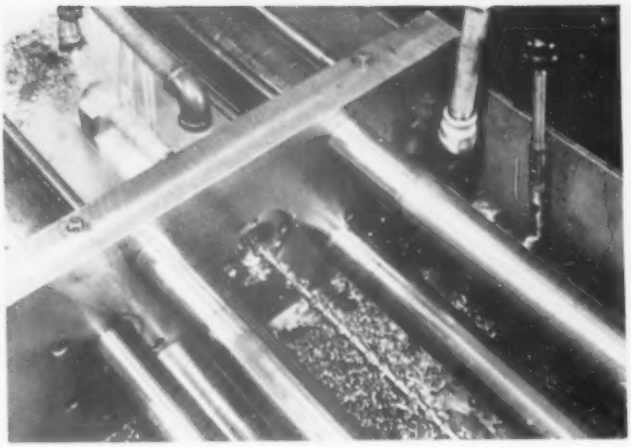


FIG. 5.

Broaching is a somewhat different operation than threading, inasmuch as there is no terrific heat created due to high speed. The result is that a soluble solution seems to penetrate and lubricate a broach a lot better than a heavy base oil; also, it seems to have more of a soapy, slippery action than does the heavy base, black cutting oil.

Having been firm believers in the use of high grade and expensive cutting lubricants, the use of a comparatively cheap and inexpensive cutting solution on broaching was quite a revelation to us. Even now, when watching the operation, the writer is reluctant to believe the evidence of his eyes. We have, on a number of occasions, gone back to heavy base cutting oils for broaching, and have tried it on a broach which had been performing very satisfactorily with the soluble oil. The change caused the broach to break!

A number of conditions must be considered when broaching a round hole. Don't place too much faith on burnishing teeth. They quickly seize and gall, and do not produce uniform holes. Machine the broach accurately. Make sure that all the different diameters are smooth.

Make the broach long as is possible and practical, and use as many teeth as is possible and practical. Also do as much of the heavy cutting with the first few teeth of the broach as possible, leaving the back teeth for finishing only. Use plenty of chip breakers, and a soluble solution for a coolant.

World's Largest Press Brake

WHAT IS SAID to be the world's largest press brake—and "figures" seem to support the claims—was recently delivered to the McKeesport, Pa., plant of the Jones & Laughlin plant by the Warren City Manufacturing Company, of Warren, Ohio, who built the colossus. J & L engineers cooperated in the design.

Of fully stress-relieved welded steel construction and weighing in excess of 250 tons without dies, the machine is designed to exert a pressure of over 1,000 tons for bending steel plate $\frac{5}{8}$" thick and up to 36' long, at right angles in a single stroke.

Infra-Red Aids in Precision Casting

BANKS OF 250-WATT infra-red lamps (in this case, a total of 248) replace steam tables, low temperature ovens and hot plates are used for drying molds and to melt out about 98% of the wax pattern at the precision "lost wax" casting foundry of the Westinghouse Electric Corporation. The balance of the wax is burned out in the preheat furnaces where molds are heated to 1000° C for casting.

The infra-red process has been found especially efficacious in the making of gas turbine blades and other hard-to-machine castings. Its use has reduced mold cracking and, consequently, has greatly reduced the proportions of defective castings.

By Henning Freden

The Case for Tool Engineering Curriculae

WHILE THE DRUMS OF WAR are not entirely stilled, as they still mutter in turbulent areas, millions of Yank veterans have already returned to civilian life and are now preparing themselves for various positions in skilled trades and professions.

The Veterans Administration program, under which these men are receiving such training, has a truly double edged purpose. First, it equips the veteran with the tools of life which help make him not only independent of further government aid, but a far more valuable citizen in the community. Second, it trains men in the development and use of the greatest weapon this world has ever known—mass production.

It has been said that the United States, which contains 6% of the world's population and 60% of its engineers, played the deciding role in World War II. Whether this is literally true or not is of little import; the records stand however, that without our long production lines, backed by sound engineering "know how," we probably would have lost the war.

Henning Freden **is Dean of the Detroit College of Applied Science. A graduate of Chalmers Technical Institute, Gothenburg, he has an unusually broad background in engineering, industry and education; consequently, his "Case for Tool Engineering Curriculae" is at once timely and thought provoking.**

No single branch of engineering could have accomplished this feat any more than one branch of the armed forces could have conquered the enemy; however, the war has shown this country the importance of tool engineering and the part it should play in future preparedness programs.

The war has also brought out the significant fact that, on the most conservative basis, one tool engineer is required for each product engineer. Yet, even today, we find that there are no degree granting schools teaching tool engineering. In fact, less than a half dozen schools of any kind are teaching this type of engineering. Aside from the fact that most colleges feel that tool engineering is out on a degree granting level, there also remains a lack of text books necessary to properly compile a tool engineering curriculum.

More Textbooks Needed

The Detroit College of Applied Science, which has been teaching tool engineering since 1926, has had to construct its own texts in pamphlet form, and it was not until early this year that the school, through Prentice Hall, published its first volume on *Applied Industrial Mathematics* for tool engineers. The second volume should be ready within a year. These two books interweave physics, mechanics, strength of material, and mathematics from arithmetic through integral calculus.

Other needed texts on tool engineering are also being compiled and should soon be on the market, thus enabling colleges to follow a standard curriculum. However, close cooperation is needed in the development of these texts in order to avoid duplication of material. This cooperation should be also extended to further the construction and adoption of standard courses, on institute or college levels, so that credits can be exchanged between schools.

It is felt by the writer that the guiding power behind this move should be the American Society of Tool Engineers. Our tool engineers should cooperate in the streamlining of these courses, as they have in the streamlining of present day manufacturing processes.

More Time for Tool Engineering

Now is the time to consider whether to follow the present college methods of separating each subject, without a direct co-relationship to any other, and whether the courses should be allowed to contain general problems and formulae, needed by civil, chemical or mechanical engineers, or be so constructed as to specifically apply to tool engineering only. This procedure would allow 25% more time for tool engineering subjects and would tend to produce a better trained engineer.

Since the American Society of Tool Engineers is the backbone of tool engineering, this organization should have a voice in shaping its destinies not only in industry but also in the schools. No better investment could be expended, therefore, than to maintain a standing committee to watch over, not only the academic standards of all schools teaching tool engineering, but to actively participate in the preparation of texts, curricula, and the compilation of library material, all of which must be available to schools wishing to teach tool engineering.

* * * * * * * * * * *

We agree, with the Dean of the Detroit College of Applied Science, that there are no engineering schools granting a degree course in Tool Engineering at this time. Nevertheless, a number of engineering institutes—notably Rochester Institute of Technology and Ohio State University—teach tooling technology in connection with Mechanical or Production Engineering courses. Thus, there is a start toward a goal long since set up by the American Society of Tool Engineers.

As for setting up a committee, the author apparently overlooks the fact that the Educational Committee, A.S.T.E., headed by Past President Otto Winter, has been hard at work doing the very thing he proposes. And this Committee is making definite progress, despite the barriers of tradition, toward the desired goal.

While fully cognizant of the value of the D.C.A.S. textbooks on Tool Engineering, and notably the book on "Applied Industrial Mathematics," it is pointed out that the first volume on "Elementary Jig and Fixture Design" is also an invaluable treatise on Tool Engineering. This work —of which Vol. 2 is being compiled—is a joint project between the A.S.T.E. and the New York State Vocational and Practical Arts Association and is enjoying widespread acceptance and commendation. In addition, the American Society of Tool Engineers has a $20,000 project, at Rochester Institute of Technology, in preparing a text book on "Manufacturing Analysis." Thus, through sound investment in education, the A.S.T.E. is definitely shaping its destiny.

The Editors.

By Thomas A. Dickinson

31-20000

Report On Vacuum Tools

In which the author explains the principles of vacuum techniques and their application to tool engineering

ALTHOUGH VACUUM PUMPS and related equipment have had a number of industrial applications for many years, it can be safely said that only the surface has been scratched in the development of practical vacuum techniques—especially so, insofar as the Tool Engineer is concerned—and that many new vacuum developments or applications can be expected in the much-prophesied Scientific World of Tomorrow.

According to theory, a vacuum is created by reducing the pressures on or within a gaseous substance such as air so as to increase the distances between molecules in the substance. Pressures which produce vacua are measured in terms of millimeters of mercury (commonly abbreviated as "mm. Hg."), and their range is well below the 760 millimeters of mercury generally classified as one atmosphere.

The useful quality of work in a gas is known as the *mean free path*, and may be determined by the average distance a molecule travels at the prevailing pressure before it might collide with another molecule in the gas. Assuming that d is the diameter of a molecule, we can say that two molecules collide when their centers are separated by a distance of d and designate the target area of a molecule as πd^2; and, if there are N molecules per unit volume, the number of molecules in a thickness t of cross-section S is NtS—resulting in a target area of πNd^2tS.

When $\pi Nd^2tS = S$, the target formed by the molecule fills up the whole area S, so that no molecule can traverse the distance t without a collision. The value of t, in this instance, is equivalent to $\frac{1}{\pi Nd^2}$ since t is the mean free path. However it has been demonstrated that more accurate results can be attained by computing t as the equivalent of $\frac{1}{\sqrt{2}Nd^2\pi}$ (being 0.00001 centimeter at atmospheric pressure, and 1.0 cm. at 0.0076 mm. Hg.).

Pumps which will produce high vacua may be roughly divided into two classes:

(1) Mechanical pumps, or pumps which extract air from a vessel at atmospheric pressure.

(2) Pumps which require a fore-vacuum, or which function only below certain limiting pressures.

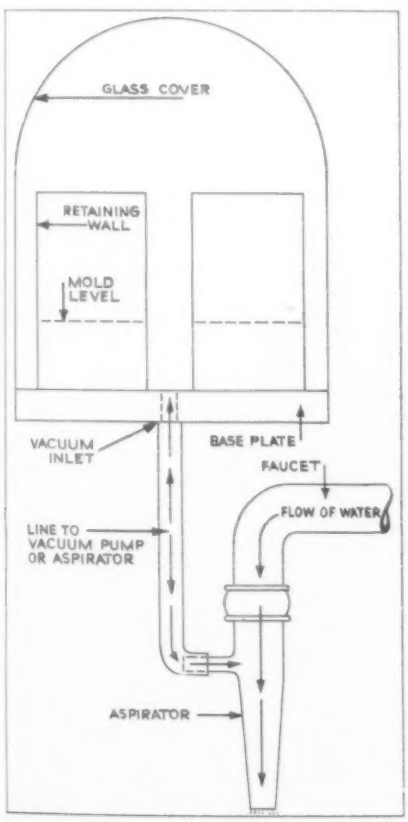
Adequate Preparation Essential

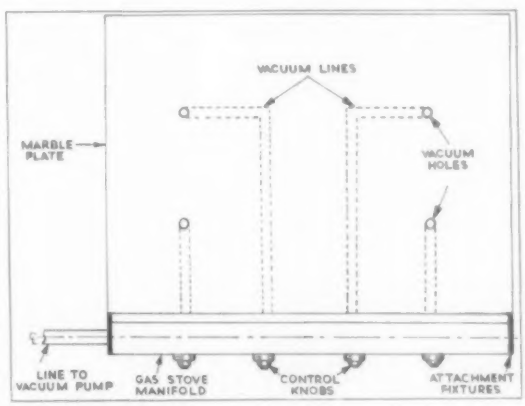
Most prominent of these for industrial usage are pumps in the first group, commonly called "backing pumps." They include water-jet pumps or aspirators (which may be operated by the flow of water from a faucet), Gaede or rotor pumps (in which a steel cylinder is usually rotated so as to produce varied pressures), and the Cenco-Hyvac oil pump (which is similar to the Gaede pumps, except for the fact that its essential mechanism is immersed in oil).

The second group of pumps include molecular, mercury-diffusion, and oil-diffusion types—which produce the lowest pressures, even though they have thus far been limited to laboratory usage. They usually must be evacuated for operation with backing-pump mechanisms, and for this reason their use can normally be justified only by the need for extremely low pressures, or pressures which average about 10^{-6} mm. Hg.

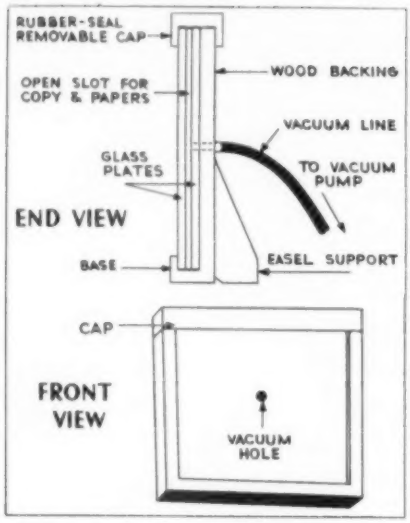
Vacua can be measured with a variety of accurate gages, and the efficiency of a pump in evacuating a given area depends on the size and operating speed of the pump mechanism. Therefore, it is extremely important to make sure that adequate equipment will be available before preparing tool designs or production plans which call for the use of a vacuum setup.

Possibly the classic application of vacuum equipment is in the evacuation of glass containers for light bulbs, valves, and cathode ray tubes. This involves the removal of gases not absorbed or absorbed by the materials in a specified container, and, when extremely low pressures must be maintained in a vessel over a long period of time, the vessel must be preheated and treated with special chemicals (such as barium or magnesium, known as "getters" because they combine with residual gases during volatization) or the removal of surface layers of vapor or grease with a bombardment of positive ions.

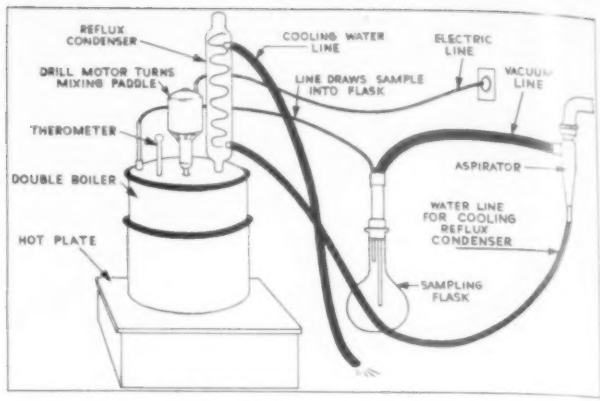




At left, a single-hole vacuum plate, with glass covers, for various types of casting. Below, top view of multi-hole vacuum plate, made with gas stove manifold.



At left, structural details of a vacuum easel, such as may be used to reproduce templates from scale drawings on paper. At right, schematic drawing showing a setup of the type that has been used to facilitate the condensation reaction of chemicals. It makes use of an aspirator-type vacuum pump to withdraw specimens from the mixing pot.



As a rule, the preheating calls for a temperature just below the lowest softening point for any material in or on the container. A small check-valve unit, within or attached to the container-base assembly, prevents the re-entrance of air into a globe or tube after vacuuming and all pumping operations must be carefully timed—since inadequate pumping results in an inferior product, while excessive pumping may destroy that product long before it can be shipped to the customer.

Another more or less standard vacuum technique has long been used in casting rigid or flexible molds with cold, or hot-setting materials such as metals, plasters, plastics, rubber, etc. In this capacity, a marble or metal vacuum plate is generally used and it may have one or several holes connected by means of airtight tubes and fittings to a manifold and/or a vacuum pump.

When casting is to be done on a porous pattern or in a porous mold, the mold or pattern may be positioned directly over a vacuum hole so that air can be withdrawn from the cast material through the pores of the mold or pattern, preventing air-bubble defects and increasing the density of the solidified cast.

If non-porous molds or patterns are used, a glass cover is positioned over the vacuum plate and high retaining walls may be arranged so that the vacuum will serve an identical purpose by withdrawing air from the upper or open side of the cast material. In the latter case, a high retaining wall is generally required to enable the cast material to rise without overflowing as air bubbles are removed. As heretofore intimated, vacuuming is normally most effective when warm or hot materials are cast or otherwise processed since heating tends to lower gas pressures, thus supplementing the work of a vacuum pump.

In metallizing glass and other materials (as for the production of mirrors), the efficient use of a vacuum in an airtight chamber permits the adhesion of metallic coatings to slick or non-porous surfaces. This results in permanent bonds that could not be achieved by more conventional means. Also, asbestos sheet, string, paper, and wool products have been manufactured in large quantities without the use of expensive press equipment by vacuum-forming in airtight ovens.

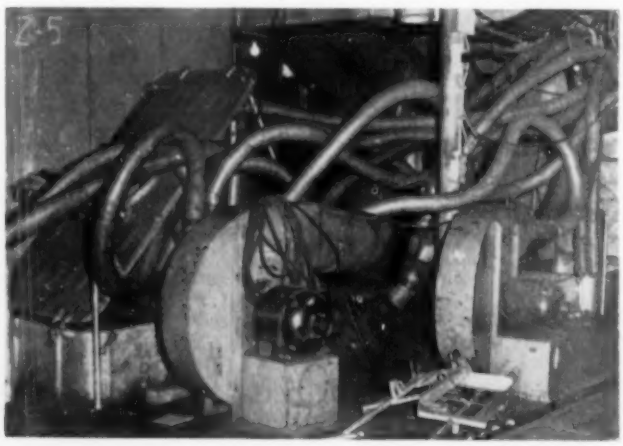
Vacuum equipment is especially useful in the manufacture of alkali metal and other materials which oxidize readily at atmospheric pressures, since it permits the removal of harmful quantities of oxygen from reaction vats or chambers. Accordingly, it is not surprising to note that photographic film and paper manufacturers have been developing vacuuming setups for several years.

Used for Template Reproduction

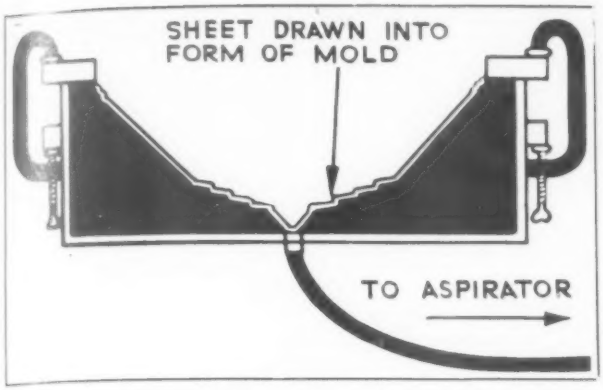
Among the more recent adaptations in photographic work is the vacuum easel, which permits the rapid and accurate reproduction of templates and designs from original drawings on paper by means of both camera and contact-printing techniques. As indicated in an accompanying drawing, such easels are airtight frames with glass panels, to permit light exposures, and with vacuum attachments which will facilitate the use of low pressures to flatten both copy and reflex or contact papers. The flattening action of the vacuum minimizes the distortion that has too often characterized photographic drawings in the past.

Although the air-compression pump and the vacuum pump are theoretical opposites, it is possible for a single pump to service as both a compressor and a vacuuming unit. Further,

The vacuum setup shown here comprises 3 to 25 H.P., with suction lines deigned and arranged to dispose of obnoxious fumes.



Shown here are a few of many plastic articles and laminates that have been molded or otherwise fabricated by means of low-pressure vacuum equipment. Their manufacture entailed comparatively inexpensive equipment.



A vacuum mold arrangement of the type that may be used in fabricating hollow, contoured articles from heat-softened thermoplastic sheets.

it is possible and even economically feasible in many cases to use a vacuum in place of a pneumatic mechanism. For instance, where one-dimensional clamping action is required to hold or support various units in a jig or fixture, an open-ended vacuum line can often be set up and used at a comparatively low tooling or production cost and with approximately the efficiency of an air-cylinder clamp.

Experiments in one West Coast factory have recently indicated that the cost of extruding many meltable materials can be reduced, without a parallel loss in efficiency, by using a vacuum as the force that will draw molten or semi-molten compositions through an extrusion die.

In the lamination of both flat and special shapes with materials such as glass or cloth fibers and resinous binders, the vacuum is currently attaining much popularity as a substitute for compressed air in either autoclave or flexible-bag setups, because it does not produce the air-bubble or "blister" defects that sometimes characterize air-pressure moldings.

First, the layers of resin-impregnated laminae are suitably positioned in or on a mold. Then the covered mold is placed in the rigid or flexible pressure chamber, which is sealed so that the maximum forces of a vacuum pump may be utilized therein. When a flexible rubber or synthetic-rubber bag is used, the efficiency of vacuuming action becomes immediately obvious because the bag itself will soon deflate and assume the mold contours. Autoclave setups are used in place of flexible bags when high curing temperatures are essential.

Adapted to Contoured Shapes

For the fabrication of glass and ceramic materials, vacua have been used in place of air-pressure or blowing techniques to facilitate the fabrication of optical lenses, which must be cooled with deliberate slowness after molding, and to draw unusual shapes from softened or partly-hardened stock sheets.

The latter procedure has also been adapted to the work of producing contoured shapes from prefabricated acrylic sheets (such as those made with Lucite and Plexiglas) and from other types of thermoplastic stock. Either a male or a female mold may be used in vacuum forming a given shape, and in either event the tooling cost is comparatively slight. The two general fabrication techniques are as follows:

(1) A heat-softened thermoplastic sheet, supported by a suitable handling fixture, is removed from an oven and clamped over the top of a hollow and rather deep chamber. When suction is created by a vacuum connection at the bottom of the chamber, the sheet is drawn downward into a bowl-like shape. Then a male die is lowered into the bowl depression, and the vacuum is turned off so that the sheet will snap back and assume the contours of the die as it hardens to room temperature.

(2) A heat-softened thermoplastic sheet, supported by a suitable handling fixture, is removed from an oven and clamped over the cavity of a female mold—approximately the same as the sheet in the initial process was clamped over a hollow chamber. Then a vacuum is applied so that the sheet will be drawn down to the contours of the mold cavity. The vacuum in this case is turned off only after the sheet has been adequately hardened to the cavity contours.

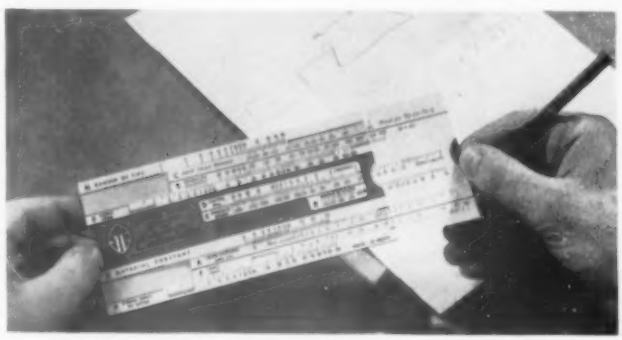
In plant-processing setups, as shown here, vacuum equipment may play several roles ranging from the removal of fumes to the prevention of oxidization.

Molds for this sort of work can be modeled or carved from inexpensive materials such as modeling clay, plaster, and wood. They are ready for use after sanding, sealing with shellac, and coating with an oil or wax parting agent; and, if they are handled with sufficient care, they can be used indefinitely to produce the deepest draws (such as one-unit aircraft gun turrets) without deterioration and without causing great stresses or strains in the finished products.

In plants where metals must be reclaimed by refluxing, or where detrimental fumes will be the result of some production process, a vacuum setup can be an irreplaceable item of equipment—even if air conditioners or fans happen to be obtainable or available—since it can be used to draw off the unwanted vapors to a tank containing water or some neutralizing agent without endangering the health and happiness of an entire neighborhood. This may not sound like an important tooling consideration, but it's well worth remembering in designing equipment for new processing units. As an example, manufacturers in one large American city estimate it cost them $5,000,000 in 1946 alone to appease community wrath as a result of overlooking this seemingly-minor item.

Rapid Pocket Calculator

SPEEDS, FEEDS AND H.P., for carbide milling, can now be quickly ascertained by even comparatively inexperienced job setters by means of a slide rule type pocket calculator, recently introduced by the Super Tool Company, 21650 Hoover Rd., Detroit. The proper cutter to be used for various hardnesses and types of slice, as well as non-ferrous materials, and tooth load, spindle RPM, and table feed are all readily computed. The calculator is priced at 50 cents.



by Watson N. Nordquist

Transfer-Matic Speeds Production

Cross 5-Station Automatic Cycle Machine produces 150 Rear Axle Housings hourly with Single Operator

AN AUTOMATIC CYCLE MACHINE, with a potential production of 150 or more rear axle housings machined hourly, with only one operator, is one of the latest developments by the Cross Company of Detroit. Engineered and built by that organization for the Ford Motor Company, it is one of a pair designed to speed production, eliminate manual handling between operations, and insure a greater degree of uniformity in quality.

This machine, which is another Transfer-Matic—as Cross calls its special machine tools which employ a transfer mechanism for continuous automatic production—consists of opposed machine units, at five stations, all operating simultaneously on opposite ends of two axle housings.

The station heads, which move horizontally on hardened and ground steel ways, are standard self-contained Cross hydraulic units, thus providing for maximum flexibility in the event of future design changes. Hydraulic power to the heads is supplied by Vickers pumping units, which, in turn, are powered by General Electric K-type, 3-HP induction motors. Control is by Allen-Bradley limit switches. Control panels, incorporating Square D starter units, were built by the Leahy Company, Detroit, in collaboration with Cross engineers.

Idle stations are provided, between operating units, for accessibility and to allow for removal of parts between operations, should this be necessary or desired. Also, individual controls are provided for the several stations; however, these are used only in case it is desired to operate the heads independently, as, for example, when resetting the tools. The machine is engineered for carbide tooling.

In the event of trouble at any one station, operation at that point immediately stops and a trouble light shows on the shoulder-high control panel, indicating the unit that requires attention. The master panel also shows the completion of cycle at each of the heads.

To operate, the one operator loads two housings on the transfer table and, with one button, sets the automatic cycle mechanism into operation. The transfer table picks up the work from all stations, moving it forward to the next, viz.: From loading to No. 1; from No. 1 to first idle; first idle to No. 2, and so on to the final operation. The table lowers, leaving the work in position in the holding fixtures, and returns to a position ready to pick up the work on the next cycle. All positioning and holding fixtures are automatic and, once the parts are clamped, the cutting tools move into the work.

The cutting tools are cooled with flood coolant which, pumped at the rate of 10,000 gallons per hour, is carried under the entire length of the transfer table, thus serving the additional function of clearing it of chips.

Sequence of Operations

STA. 1. Overhead locator with internal expanding jaws lowers into banjo opening of axle housing, while clamps are applied at either end of housing for exacting accuracy and rigidity. Machine heads move in laterally to rough bore three inside bearing surfaces and to chamfer between two, on both ends of housing.

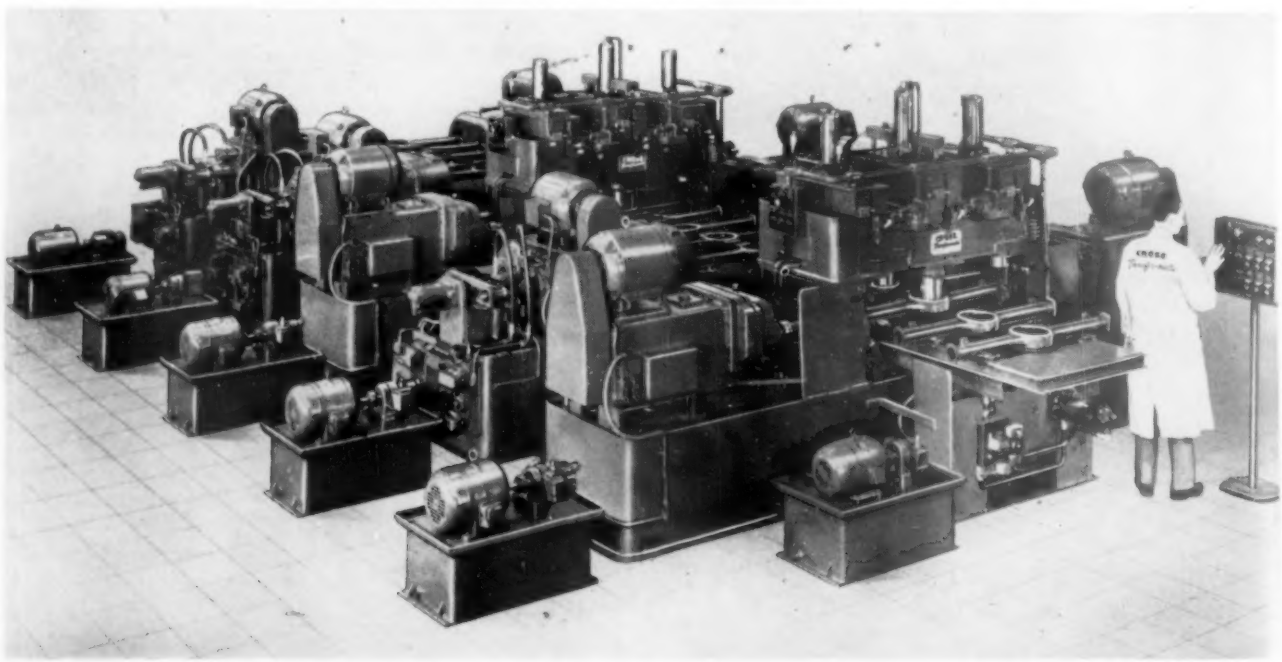
STA. 2. Axle housing is supported at differential case by jig, and located by pilots fed laterally into the rough-bored ends of housing. This provides sufficient accuracy for back-turning O.D. behind the end flanges for bolt clearance and also to turn the O.D. of end flanges for clearance.

STA. 3. Located as at Sta. 1, finish bores inside bearing surfaces.

STA. 4. Located as at Sta. 2, rough straddle faces end flange.

STA. 5. Located and clamped as at Sta. 4, finish faces outside of end flanges.

The Cross "Transfer-Matic," Parts move progressively from loading, at front as shown, to discharge at far end.

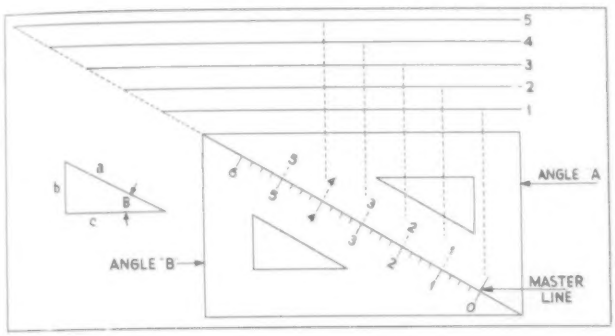


GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

To Draw Parallel Lines

WHEN PARALLEL LINES are required at certain distances apart, the use of two scribed 30-60 drafting angles, as shown in the drawing, will be found very convenient. Angle "A" must have only one marking, which is called the master line. Angle "B" can be graduated in 1/16" or smaller spaces if desired. The first graduation on angle "B" should be made directly opposite the master line on angle "A" when both angles are at the position shown.



A 1/16" graduation or spacing of the parallel lines requires the use of 1/8" graduations on angle "B." This can be proven by using the formula: a = b sin B, as applied to the small triangle inset into the drawing. Parallel lines 1, 2, 3, 4 and 5, shown in the drawing, can be drawn by setting the master line on angle "A" at stages 1, 2, 3, 4 and 5 on angle "B." This system of using two angles is also useful on the adjustable parallels.

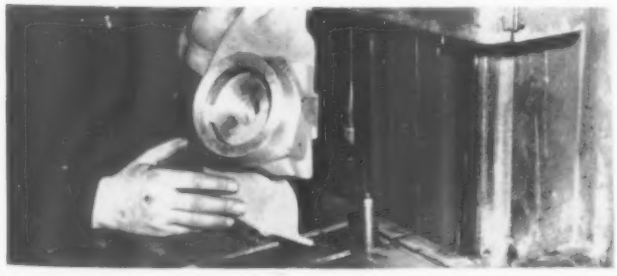
Edmund L. Johnson
Pittsburgh, Pa.

Simple Fixture Ups Production

The job was to machine a surface on the side of an aluminum gear housing, as shown at right of part in the photo. With a previous expensive fixture, output was at the rate of 43 pieces per hour—far below demand. Consequently, the job was switched to a Porter-Cable Model BG-8 wet belt grinder, with the "fixture" consisting of a simple pin, bolted to the machine table.

In operation, the part was slipped onto this pin, and then pushed against the abrasive belt of the machine, which removed the required stock, to close tolerances, in a matter of seconds. Output jumped to 167 pieces per hour, the whole a good example of fundamentally sound tool engineering.

Contributed.

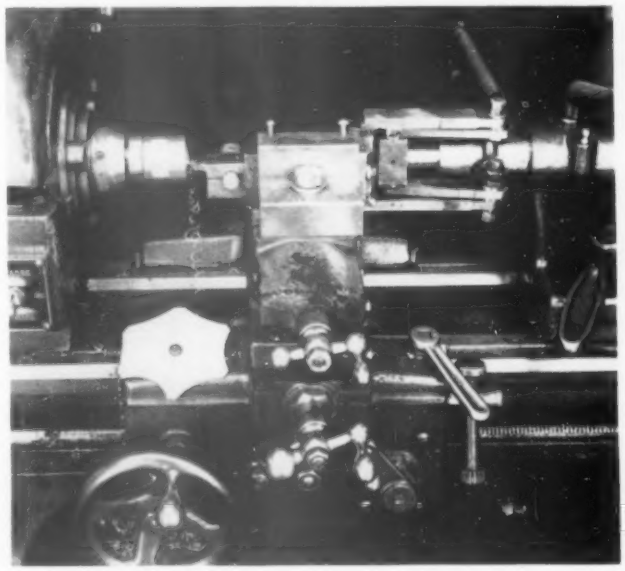


Unique Radius-Turning Tool

A WELDING LABORATORY needs versatile equipment to try out a variety of ideas over a wide range of applications. One of these needs is a means of obtaining a true spherical surface on spot welding electrodes. This can be done with a forming tool, but they are difficult to grind accurately and may chatter in a small lathe that has a little looseness in the cross slide or carriage.

In order to meet this situation, a special device was built at the Thomson Laboratory of the General Electric Company. It is adjustable for any radius from one to three inches and uses a regular 1/4-in. square tool bit.

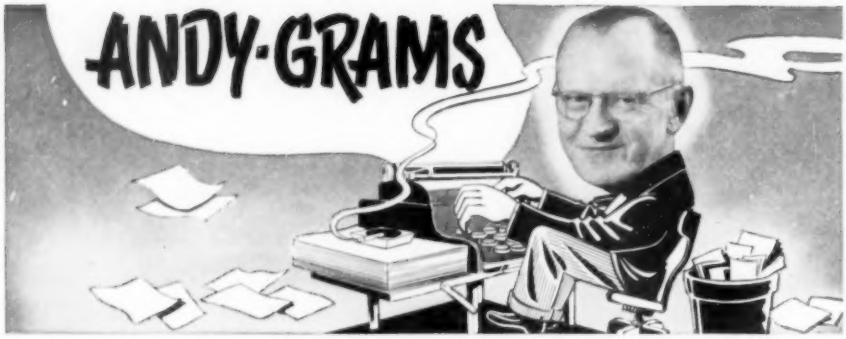
The special device consists of a sliding head carrying a tool holder, which has a rocker adjustment to bring the point of the tool to the center line of the work. The sliding head is free to move in gibs of the body, which replaces the regular tool post. The other end of the sliding head has extensions connected to links by pivot pins. The fulcrum of the links is mounted on the tail spindle by means of a taper which replaces the center. Light springs are connected to the pivots to keep backlash in one direction.



In operation, as the cross-slide is moved toward the center, the pivot points swing through an arc of a circle. This movement is duplicated by the tool, through the medium of the sliding head. The depth of cut of the tool is adjusted by the tail spindle. When the tool is ground with a little negative rake, a true spherical surface is produced on electrode tips, without polishing or other operations.

For proper set-up, the cutting point of the tool is on dead center when the links are folded and lie parallel to the tail spindle. The zero marks on the compound rest should be matched very accurately, otherwise, the form will deviate from true spherical.

Fred Davis,
Thomson Laboratory,
General Electric Company,
Lynn, Mass.



AS I PREDICTED in November (written before the Semi-Annual), the Boston "Tea Party" was a huge success. Sure, the attendance could have been heavier, but considering that so many of the members had attended the recent Machine Tool Show, and couldn't get away again so soon after a protracted absence, the turnout was good. So was the "Tea Party"!

At this point, I might as well tell you that I lost all my notes enroute, and will therefore have to work from memory. Not that the loss of notes makes much difference a/c I usually can't read 'em anyway. But, once unscrambled, they're a sort of moral support, and now I'm left without visible props. Please bear with lapses.

First off, I want to tell you that, for the first time at an ASTE Convention, I had the pleasure of having the silent (?) partner with me. It so happened that we honeymooned in Boston, and I prevailed on her to come along and revisit old scenes. But it rained, so we confined our tour to a few historic spots, including the hill where the "Lowells spoke only to Cabots", and a visit to a cousin, resident in Medford, after which she went on to Providence, our erstwhile home town. Of that, more later.

On and off, during the Convention, sat in the bleachers watching our Directors at work, and while they all did well, attention more or less centered on the newer members of the Board—Grant Wilcox, Carl Bues, Herb Tigges, King Cole, Rip Collins and Tom Donovan. As past prex Jim Weaver put it: "Those boys have plenty under their hair." Anyway, they performed like seasoned veterans.

Speaking of past prexies, they were all there but three—Frank Shuler, Walter Wagner and Ford Lamb, the latter a casualty of office. But Joe Siegel was there, and Bert Carpenter, debonair as ever, and Bill Smila, long time head of the Standards Com'tee. Incidentally, I've given up trying to get Bill's shirt. Let him keep it!

Bob Lippard, nary a hair out o' place as usual; Al Sargent and Clete Briner, both on the Board; Frank Curtis and Ot Winter, respectively busy on the Handbook and Education Com'tees; Doug Burnside, stopping off enroute South; and H. A. d'Arcambal who, of all things, takes his glasses *off* to read. And Ray Morris, looking none the worse for Prex Truman's food conservation program. Incidentally, I ran across the junior member of the Morris clan—young Bob, who wanted to know if I was fired out of Pratt & Whitney's and if not, why not. (Maybe I beat 'em to it).

Dropped in on the Handbook Com'tee a/c I wanted visual proof of what I've been saying right along—that the boys are hard at work winding up the tome for spring delivery. Then in on the Educational Com'tee, where I met all the brain trusters and got a p.g. course in astronomy that still leaves me wondering.

Speaking of astronomy, Mrs. Burnside read my fate in the Zodiac. Seems I'm a Libra, which makes me well balanced. Not that there's any particular connection between astronomy and astrology, but I just thought I'd let you boys know that I'm on an even keel in spite of everything.

Coming back to the Educational Com'tee, I barged in just in time to get into a discussion on perpetual motion, which brought up the old saw that our solar system is proof of perpetual motion only it ain't a/c the earth slows down a thousandth of a second every century from which you can easily (?) figure out when it'll come to a standstill.

"What I object to," sez I, "is the astronomers telling us that the moon rotates on its axis and yet keeps the same face turned toward us all the time. The very fact that we see only one side precludes all possibility of rotation."

"Ah," said an erudite* gentleman who, it turned out, was Prof. Earle D. Buckingham of M.I.T. "what you say is only relatively true. Now, if you were to project yourself out into space . . . ." And with that, the topic veered off into progmatism, only I'll not go into that now a/c it just keeps you running in circles. Later, from a discussion with Prof. Prescott Smith (also of M.I.T.), I gathered that Swedish engineers are too theoretical to be practical. Now I won't need the sunlamp I was going to buy.

I thought I'd heard about everything, but during a chat with Warren Ames, he brought that a West Coast vet, starting in the manufacture of food products, had ordered several Ames indicators with which to measure the thickness of potato chips. Other manufacturers, again, use indicators to measure the thickness of pie crust and —of all things!—soap chips. But why not? Control of quality is an important item in any process of manufacture.

Incidentally, Warren spoke very highly of Erik Aldeborgh, prex of Standard Gage Company, Poughkeepsie. I like that spirit, so typical of the friendly rivalry between tool engineers. Rambling around, I learned that the B. C. Ames employees had staged a surprise party on Warren—but, 'nough said. We'll let Doris Pratt tell you about that in the ASTE News.

Met Dick Stanton, Pratt & Whitney v. prex, with whom I exchanged reminiscences of the time when State St., Hartford, was—well, no place for the minister's son. Seems that Dick was out, one wintry morn, trying to round up one of his ace scrapers whom, for the sake of anonymity, we'll call Yens Yensen. (This one's for King Cole).

Dick found Yens in Niels Nielsen's dispensary of liquid cheer, where they were baiting him on to yump from the roof into a big snowdrift. And Yens yumped. What no one had bothered to ascertain was the "drift" was just a thin veneer of snow atop a pile of cordwood!

It was a cosmopolitan gathering, with representation from the four quarters of the States, Canada, South America and Europe. From Canada, popular V. Prex Bob Douglas, Bill Dawson, Eric Crawford, Jerry Rogers, Dick Faller, Jack Walton and Tom Alison. From Brasil, Eugene Lahr, whom I had met at the Chicago Show and who ribbed me about misspelling his present home town in the October book. But then, they pronounce São as San, so I was merely phonetic. Anyway, I got the S right in Brasil.

During the Convention, met Erik Lindhe, engineer with A/B Lunden & Bonthron, Stockholm, who assured me that I spoke Swedish like a native despite my 50 years or more residence in the States. Maybe, although I'm afraid that my accent would be quite noticeable if I ever went back.

Among fellow scribes, passed the time o' day with Carl Harrington of *Mill & Factory*, Eric Crawford of *Canadian Machinery*, Ben Brosheer and Jim Linsley of *American Machinist*. Jim, by the way, considerably augmented his gun collection during his recent sojourn in England, which reminds me that my collecting has lagged of late. Golly, that reminds me!—I promised John Lapham I'd send him a box of percussion caps. Coming through, John!

Responding to invitation, I went up to the F. H. Robertson suite, where I found Frank playing the genial host and where I had the pleasure of meeting his winsome daughter, editor of the Robert-

*Erudite—the $64 question Ot Winter slipped up on.

. . . . *Flash* is it?—As aforesaid, I lost or mislaid my notes. Also John Rochford, who relayed a message from Ernie Howarth of N. A. Woodworth Company, Ferndale, Mich., who had just departed for home. However, I got Ernie on the phone so it's all jake.

Frank presented me with one of Gairing Tool Company's 6" scales, a mate to the one Slim McClellan gave me in Chicago. Now I've a whole foot. Also, a nice oil stone from Super Tool Co., Detroit (Frank handles quite a line) which comes in right handy a/c the one I got from Carborundum Company 30 years ago is almost worn out. Thanks a lot! Also, in the Robertson fold, Tom (not the Thin Man) Powell. Real friendly folks, typically Bostonese.

From Texas, Mr. & Mrs. Harold E. Collins, Mr. & Mrs. Homer Briggs, and Dean Saurenman; from the Coast, Gus Arends, Dick Linch (I'm doing my best without notes & it's human to err) and, of course, Director Carl Bues. From the northeast corner, John Johnston of Portland (Me) Chapter . . . . ? Come to think of it, I didn't run across anyone from the northwest. Must have missed one of the four corners.

Floyd McArthur, Alan Stubbs, Bill Hatfield and Ted Miller from Springfield, Vt., and Ade Potter from Springfield, Mass. Joe and John Petz from Poughkeepsie—and did they start something in mixed identity! For that matter, I got kind o' muddled myself, first taking *Modern Machine Shop's* Howard Campbell for someone else and mixing Dean Saurenman up with Doc Osborne. From a certain angle, they look somewhat alike, and I took Dean for Doc with his mustache shaved off.

Brunched with Ed Berry, and later met several of his neighbors from Li'l Rhody—Joe McGowan of Pawtucket, Lloyd Sheeran of Cranston, and a chap from Newport, whose name I can't recall except that it sounded Irish, who gave me news of the passing of an old pal.

For the benefit of Ed Doogan's Old Man, who wanted to know if I've never met any Irish tool engineers, I met (in addition to names above and such as may come to mind) Ray Murphy, who was a student at Detroit College of Applied Science when I taught design there several years ago, and now with Hydraulic HiSpeed Company; Art Murray of Electrolux (maybe he's Scotch like Slim McClellan) and, of course, Tom Donovan.

New Haven contributed Fred Dawless, Frank Shute and Mike Radecki; Rochester Milt Roessel and Jim Horne—and, of course, Dr. Mark Ellingson. (Note to Jim: If you see Harry Flodin, tell him I met both of his sisters-in-law in Providence and they relayed greetings). From Peoria, Jim Knight and Bob Bayless, and Foster Crayton from Philly, and from Rockford, Ed Dickett and George Johnson. Saw Hartford's Dick Smith in the gathering, and had looked forward to seeing John Sundkvist, but he mailed in his regrets. (You missed a nice meeting, John. Lunch with Irwin Holland and Mr. & Mrs. Doug Burnside—a most pleasant interlude.

At the banquet, found myself seated with Doris Pratt; Clarence Etter; George Sanborn of Fellows Gear Shaper; Prof. Buckingham; Warren Ames; John Schleiffer and John Cetrule, both the latter of Triplex Machine Tool Corp'n which, incidentally, is to handle Ames indicators in New York. John, who is quite a linguist, chatted volubly in Italian with the waiter and then gave me a lesson in basic Swedish. Placed as we were, we had ringside seats for the floor show and a fine view of the society brass and honored guests at the head table, all spick 'n' span in soup and fish. A really swank gathering, at which we found out that Prex Peirce is a direct descendant of Massachusetts famous governor William Bradford. Al Sargent must have been one proud guy, having his mother at the banquet.

Clayton Burt's talk had a special appeal, as bringing up old times, he established that the one and only sound basis for future development is the experience of the past. This thought may possibly be challenged—as, for example, one might contend that an inventor, starting from scratch on an entirely new idea, works without benefit of precedent. Maybe so, but I've yet to hear of the radical invention that wasn't the culmination of many a discouraging failure. Final success, if you please, was the result of experience.

The present is fleeting and measured in fractions of a second, but the future starts equally from genesis and this moment. That applies equally to the tools of civilization and to civilization itself; everything new has its roots in the old. The higher one scales a mountain, the broader the vista and the farther the horizon—but, one attains the summit only after arduous climbing.

Excuse it, please, if I made you think—a most unpleasant ordeal for us humans. Now, coming back to the Convention, you may be wondering if, with all the mention of names—and say, I'm doing okay even if I did lose my notes, eh? Which reminds me that I almost forgot Norman Brownsword; who asked me to call his sister when I got to Providence. Sorry, Norm, but I just didn't—the breaks were against me. The Host Chapter officers were complaining that the local boys were conspicuous by their absence, but about everywhere I turned some Bostonian was holding out a glad hand. But few or many, they did one swell job—just as the few who made up their forebears did when they staged the original "Tea Party".

Of course, it wasn't all fun—for that matter, all of these ASTE Convention are mainly hard work with an interspersing of diversion. The Board was in session until late Sunday, and the various Committees were burning the midnight oil as well. Then, there were the technical sessions, all well attended and each highly educational. Bob Ford and his fellow members of the Nat'l Program Com'tee stand up and take a bow. That goes for John Ryneska and his fellow workers on the Host Chapter Committee as well. Nice work, everybody!

Kept looking at W. E. Winfrey, wondering where I'd first met him, then it dawned on me that Bill Young and John Sylvester had introduced us when I first spoke in Boston several years ago. Had to come all the way back to Detroit to remember that. Didn't want to ask any embarrassing questions, but I'm still wondering what the connection is (if any) between Reception Com'tee co-Ch'man J. Lindegren, Sr., and Carl J., one or both of Worcester. It's the Sr. that gets me all mixed up; like myself, C. J. has grown out at the top.

John Geddes, big as life; Al Forbes, urbane and smiling; John Morosini; Ed Baumgardner; Stan Stedfast; Howard Rich; Fred Heatley; Henry Martin, Tom Bradford—these and many others too numerous to mention warmed us with the traditional New England friendliness. Boston's a nice town, and the Bostonians fine people. I like 'em.

As aforesaid, I mentioned a lot of names before coming to the home folks, but I just wanted to show you boys North, East, West, South that the Host Chapter has nothing to explain. They put on a good show and the "Tea Party" was a drawing card that attracted a representative ASTE gathering. Take a gander at the ASTE News and you'll see!

Sunday morning, in Providence, the Missus and I attended services at the Church on the Hill—Gloria Dei Lutheran, to be exact—and there we met friends of bygone years, changed as we were yet the same as ever once you penetrated the veneer put on by Father Time. A quick lunch and a hustle to the train, then New Yorkward on the Shore Line. Westerly, New London, a glimpse of the broad Atlantic in the offing; New Haven, Bridgeport, Stamford—each with its poignant memories.

Yessirs, it's really nice to have the wife along—you've someone with whom to share the pleasures of a trip. And personally, I hope I never get so *blase* that I can't get a thrill of pleasure from looking out the window of a speeding train. Home again, with the Tailwagger in ecstacy over the reunion. And so back to work.

Well, here it's December again—or will be when you read this—with the holidays just in the offing. And now, I want to wish all you readers, North, East, West, South a Merry Christmas and a Happy and Prosperous New Year.

ASTEely Yours,

Andy

Directory of A.S.T.E. Chapter Chairmen

AKRON, NO. 47
Second Thursday *
Herman A. Guy, *Chairman*
R. D. No. 1, Alliance, Ohio

ATLANTA, NO. 61
Third Monday *
Dwight L. Hollowell, *Chairman*
3174 Peachtree Dr., N. E.,
Atlanta 5, Ga.

BALTIMORE, NO. 13
First Wednesday *
Thomas F. Burke, *Chairman*
2802 Kennedy Ave.,
Baltimore 18, Md.

BINGHAMTON, NO. 35
1st Wed. after 1st Mon. *
Roland B. Andrews, *Chairman*
461 Vestal Road, R. D. 2,
Binghamton, N. Y.

BOSTON, NO. 33
Second Thursday *
John Ryneska, *Chairman*
Western Ave. 69-A,
E. Lynn, Mass.

BUFFALO-NIAGARA FRONTIER, NO. 10
Second Wednesday *
Albert Kirchgessner, *Chairman*
127 Columbia Drive,
Williamsville, N. Y.

CEDAR RAPIDS, NO. 71
Third Wednesday *
Robert A. Hruska, *Chairman*
2011 D Ave., N. E.,
Cedar Rapids, Iowa

CENTRAL PENNSYLVANIA, NO. 22
Second Tuesday *
Paul P. Stock, *Chairman*
460 Edgehill Rd., York, Penn.

CHICAGO, NO. 5
First Monday *
Fred J. Schmitt, *Chairman*
2727 So. Troy St.,
Chicago 23, Ill.

CINCINNATI, NO. 21
Second Tuesday *
George R. Squibb, *Chairman*
R.R. No. 1, Box 143-K,
Cincinnati 27, Ohio

CLEVELAND, NO. 3
Second Friday *
Edgar W. Baumgardner, *Chairman*
13825 Triskett Road,
Cleveland 11, Ohio

COLUMBUS, NO. 36
Second Wednesday *
Walter E. L. Bock, *Chairman*
323 Southwood Ave.,
Columbus, Ohio

DAYTON, NO. 18
Second Monday *
Edgar J. Seifreat, *Chairman*
P.O. Box 332, Dayton 1, Ohio

DECATUR, NO. 58
Second Monday *
Fred W. Sobottka, *Chairman*
1136 E. Grand Ave.,
Decatur, Ill.

DENVER, NO. 77
First Wednesday *
B. J. Hazewinkel, *Chairman*
2355 Jasmine St.,
Denver 7, Colo.

DETROIT, NO. 1
Second Thursday *
Leslie B. Bellamy, *Chairman*
220 E. Milwaukee Ave.,
Detroit 2, Mich.

ELMIRA, NO. 24
First Monday *
Edward Stachel, *Chairman*
927 Spruce St., Elmira, N. Y.

ERIE, NO. 62
First Tuesday *
Mathew H. Hetzel, *Chairman*
1140 West 31st St., Erie, Pa.

EVANSVILLE, NO. 73
Second Monday *
Frank J. Hausfeld, Jr., *Chairman*
R.R. No. 5, Box 30,
Evansville, Ind.

FAIRFIELD CTY., NO. 6
First Wednesday *
Arthur R. Hunt, *Chairman*
64 Avon St., Devon 2, Conn.

FLINT, NO. 68
Third Thursday *
Norman F. Snyder, *Chairman*
2006 Mt. Elliott, Flint 4, Mich.

FOND DU LAC, NO. 45
Second Friday *
William E. Rutz, *Chairman*
142 Dott St., Fond du Lac, Wis.

FORT WAYNE, NO. 56
Second Wednesday *
Emil W. Mellin, *Chairman*
914 W. Sherwood Terrace,
Fort Wayne 6, Ind.

FOX RIVER VALLEY, NO. 72
First Tuesday*
Roy G. Frogness, *Chairman*
17 S. Island Ave.,
Box 329, Aurora, Ill.

GOLDEN GATE, NO. 28
Third Wednesday *
Floyd V. Snodgrass, *Chairman*
2601 Maxwell Ave.,
Oakland 2, Calif.

HAMILTON, NO. 42
Second Friday *
William A. Alexander, *Chairman*
88 Prospect St. S.,
Hamilton, Ont.

HARTFORD, NO. 7
First Monday *
Richard A. Smith, *Chairman*
28 Harvard St.,
Hartford 6, Conn.

HOUSTON, NO. 29
Second Tuesday *
Homer Briggs, *Chairman*
6514 Pinehurst,
Houston 3, Texas

INDIANAPOLIS, NO. 37
First Thursday *
John Horton, *Chairman*
816 N. Audubon Road,
Indianapolis 1, Ind.

KANSAS CITY, NO. 57
First Wednesday *
Leroy E. Campbell, *Chairman*
5912 College Ave.,
Kansas City 4, Mo.

LITTLE RHODY, NO. 53
Third Wednesday *
Wilfred J. Pender, *Chairman*
43 Seba Kent Road,
Pawtucket, R. I.

LOS ANGELES, NO. 27
Second Thursday *
Leslie F. Hawes, *Chairman*
412 N. LaBrea,
Inglewood, Calif.

LOUISVILLE, NO. 54
Second Tuesday *
John E. Paskey, *Chairman*
2322 Greenwood Ave.,
Louisville 11, Ky.

MADISON, NO. 75
1st Tues. after 1st Mon. *
Fred H. Kessenich, *Chairman*
308 E. Wilson St.,
Madison 3, Wis.

MID-HUDSON, NO. 74
Second Tuesday *
John L. Petz, *Chairman*
Pendell Road,
Poughkeepsie, N. Y.

MILWAUKEE, NO. 4
Second Thursday *
Paul E. Butzin, *Chairman*
8104 Richmond Court,
Wauwatosa 13, Wis.

MONTREAL, NO. 50
Second Wednesday *
Henry T. Welch, *Chairman*
732 Victoria Ave.,
St. Lambert, Que.

MUNCIE, NO. 70
Second Wednesday *
Robert L. Waters, *Chairman*
811 March St., Muncie, Ind.

NASHVILLE, NO. 43
Third Friday *
C. L. McCaffrey, *1st V-Chm.*
1513 Ashwood Ave.
Nashville 4, Tenn.

NEW HAVEN, NO. 41
Second Thursday *
Ray E. Gifford, *Chairman*
96 Kimberly Ave.,
East Haven 12, Conn.

NEW ORLEANS, NO. 60
Second Wednesday *
Carl Hazlewood, *Chairman*
6574 General Haig
New Orleans 19, La.

NEW YORK, GREATER, NO. 34
First Monday *
Harmon S. Hunt, *Chairman*
325 Cherry St.,
Douglaston Manor, L.I., N.Y.

NIAGARA DISTRICT, NO. 65
First Thursday*
William L. Sandham, *Chairman*
94 Dunlop Drive,
St. Catharines, Ont.

NORTH TEXAS, NO. 51
2nd Friday *
Theodore A. Hersh, *Chairman*
2901 Westridge Ave.
Ft. Worth 7, Texas

NORTHERN NEW JERSEY, NO. 14
Second Tuesday *
Charles Carlson, *Chairman*
Thomas A. Edison, Inc.
Orange, N. J.

PEORIA, NO. 31
First Tuesday *
R. C. Kolb, *Chairman*
98 N. Maplewood Ave.,
Peoria 5, Ill.

PHILADELPHIA, NO. 15
Third Thursday *
Arthur R. Diamond, *Chairman*
Greene Manor,
Johnson and Greene Sts.,
Philadelphia 44, Pa.

PHOENIX, NO. 67
Third Wednesday *
Harry E. Rives, *Chairman*
Rt. No. 1, Box 43-D
Tempe, Arizona

PITTSBURGH, NO. 8
First Friday *
Paul H. Magnus, *Chairman*
Tranter Mfg. Co.,
105 Water St.,
Pittsburgh 22, Pa.

PONTIAC, NO. 69
Third Thursday *
Albert J. Rhodes, *Chairman*
1245 Rhodes Rd.,
Lake Orion, Mich.

PORTLAND (MAINE), NO. 46
Fourth Friday *
Carl L. Bohlin, *Chairman*
28 Hall Ave., Saco, Maine

PORTLAND (OREGON), NO. 63
Third Thursday *
William E. Brennan, *Chairman*
3036 S.E. 33rd Ave.,
Portland 2, Ore.

POTOMAC, NO. 48
First Thursday *
Richard P. Thayer, *Chairman*
4704 Butterworth Pl., N.W.
Washington 16, D. C.

RACINE, NO. 2
First Monday *
William P. Clark, *Chairman*
2105 Washington Ave.,
Racine, Wis.

RICHMOND, NO. 66
Second Tuesday *
Lowell B. Penland, *Chairman*
2509 E. Main St.,
Richmond, Ind.

ROCHESTER, NO. 16
First Monday *
Milton L. Roessel, *Chairman*
97 Biltmore Drive
Rochester 12, N. Y.

ROCKFORD, NO. 12
First Thursday *
Earnest Y. Seborg, *Chairman*
1523 Huffman Blvd.,
Rockford, Ill.

ST. LOUIS, NO. 17
First Thursday *
Edward H. Ruder, *Chairman*
57 Hanley Downs,
Richmond Heights 17, Mo.

SAN DIEGO, NO. 44
Second Tuesday *
Raymond W. Peters, *Chairman*
6952 Fitch Ct.
San Diego 11, Calif.

SCHENECTADY, NO. 20
Second Thursday *
John Stedman, *Chairman*
54 Broderick St.
Albany 5, N. Y.

SEATTLE, NO. 39
Second Tuesday *
Gordon Munro, *Chairman*
Rt. 4, Box 2432
Bremerton, Wash.

SOUTH BEND, NO. 30
Second Tuesday *
Edgar W. Helm, *Chairman*
1152 E. Victoria St.,
South Bend 14, Ind.

SPRINGFIELD (ILLINOIS), NO. 64
First Tuesday *
Henry G. Becker, *Chairman*
830 No. 5th St.,
Springfield, Ill.

SPRINGFIELD (MASS.), NO. 32
Second Monday *
Alexander W. Todd, *Chairman*
50 Johnson St.,
Springfield 8, Mass.

SPRINGFIELD (OHIO), NO. 76
First Monday *
James B. Douglas, *Chairman*
609 E. McCreight,
Springfield, Ohio

SYRACUSE, NO. 19
Second Tuesday *
Hugo C. Klix, *Chairman*
425 Glenwood Ave.,
Syracuse 7, N. Y.

TOLEDO, NO. 9
Second Wednesday *
Albert Hage, *Chairman*
3700 Roanoke Rd.,
Toledo 12, Ohio

TORONTO, NO. 26
First Wednesday *
L. M. Jardine, *Chairman*
6 Pepler Ave., Toronto, Ont.

TRI CITIES, NO. 23
First Wednesday*
Lennart N. Dahlen, *Chairman*
901 43rd St.
Rock Island, Ill.

TWIN CITIES, NO. 11
Second Tuesday*
Clifford V. Lofdahl, *Chairman*
5933 Elliott Ave. S.,
Minneapolis 7, Minn.

TWIN STATES, NO. 40
Second Wednesday *
Alan E. Stubbs, *Chairman*
Highland Rd., Springfield, Vt.

WESTERN MICHIGAN, NO. 38
Second Monday *
Peter C. Maghielse, *Chairman*
2434 Miller Ave., N. W.
Grand Rapids 4, Mich.

WICHITA, NO. 52
Second Wednesday *
Harold J. Bales, *Chairman*
1702 N. Lorraine Ave.,
Wichita 6, Kan.

WILLIAMSPORT, NO. 19
Second Monday *
Lewis H. Bardo, *Chairman*
2347 Hillside Ave.,
Williamsport, Penn.

WINDSOR, NO. 55
Second Monday *
R. T. Richards, *Chairman*
R.R. No. 1, Windsor, Ont.

WORCESTER, NO. 25
First Tuesday *
Charles W. Monigle, *Chairman*
364 Greenwood St., R.F.D. 2,
Millbury, Mass.

* CHAPTER MEETING NIGHT

A·S·T·E· NEWS

'Hub' Convention Draws Hundreds from Afar

Industry Asks Technical Aid in Surmounting Dilemma

COMING FROM Chapters in 47 cities, including points in Texas, the West Coast and Canada, and from overseas and below the equator, ASTE members and guests converged on the "Hub" for the three-day "Boston Tea Party," October 30-November 1.

Headquarters for the 15th Semi-Annual Meeting was Hotel Statler, but field trips ranged over a large area of the Old Bay State. Although Dame Boston staged a nor'easter to remind the engineers that they were gathered on the Atlantic coast, the visitors were undeterred.

Industries pioneered in New England were prominent on the technical program. One, contemporary with the Revolution, was initiated by Thomas Harland, an English clockmaker who came to America in 1773 on the ship that carried the original Boston Tea Party cargo, according to W. E. Mutz, Treasurer, Chelsea Clock Co., Chelsea, Mass., who keynoted the watch and clock tooling session.

And another New Englander, Henry Warren, was the inventor of the electric clock, and the requisite master clock installed in power plants to control electric current frequency and insure correct timekeeping by synchronous-motored clocks. This and other background information was included in a discussion of tooling for electric clocks by H. B. Whitehead, Gen. Supt., Telechron, Inc., Ashland, Mass.

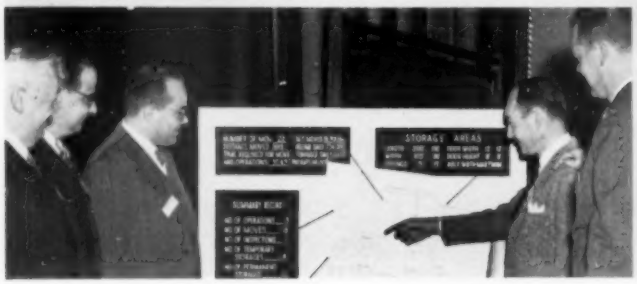
Problems in tooling for fine watches as set forth by E. W. Drescher, Supt. of

(Continued on next page)

PEOPLE

And EVENTS

Top—Upper left: W. B. Peirce, ASTE President, and F. U. Conard, President, Niles-Bement-Pond Co., smile at *bon mot* by C. R. Burt (right), Chairman of the Board, N.-B.-P. Co. and honor guest at the banquet. Right: National Program Chairman R. W. Ford takes time out to give his committee assignments for the Cleveland convention next spring. From left: G. A. Rogers, J. O. Horne, H. M. Windsor, Central Office Secy. to committee; F. J. Schmitt, Mr. Ford, E. W. Baumgardner, A. A. Nichols and H. E. Linsley. Lower left: Caught in the registration crowd are: Mr. and Mrs. T. C. Bradford, Mr. and Mrs. C. W. Monigle, Mr. and Mrs. E. Harper, Worcester, and E. J. Ljunquist of Boston. Right: Convention chairman J. X. Ryneska checks with some of his committeemen. From left: J. B. Savits, Mr. Ryneska, J. U. Reid, W. W. Young, and W. E. Winfrey. Bottom: Boston's hospitality to the ASTE ladies is shown in these glimpses of groups at Bonwit-Teller fashion show, broadcast at Radio Station WNAC, and china lecture at Paine Furniture Co.



Upper left: Speakers from Norton Co. discuss their presentation during luncheon with Society officials. From left: G. T. Rideout and A. A. Klein; W. B. Peirce, R. W. Ford and H. E. Conrad of ASTE, and W. T. Montague. Right: A. A. Nichols (right), Bearings session chairman, presents Certificates of Appreciation to (from left): Lewis Sandler, E. W. Miller and F. E. Ericson following their lectures. Lower left: Thomas Parlon explains Vis-O-Graf summary record of material handling to his fellow speakers (from left): E. J. Burnell, C. A. Litzler, P. R. Minich, and E. W. Baumgardner (right) session chairman. Right: Program Committeeman J. O. Horne (right) questions his speakers concerning products and parts displayed at watch and clock tooling session. From left: H. B. Whitehead, W. E. Mutz, E. W. Drescher, R. M. Tarpy

TECHNICAL

SESSIONS

Production, Hamilton Watch Co., Lancaster, Pa., were contrasted with techniques for mass production of watches and clocks, described by R. M. Tarpy, Managing Director, Vulcan New England Co., West Hartford, Conn.

The achievement of a superior laboratory-developed abrasive, as related by speakers from Norton Co., Worcester, Mass., was published in the technical section of the November *Tool Engineer*.

The session on Bearing Applications was leavened by anecdotes concerning experiences in the machine tool industry, told by E. W. Miller, Vice-Pres. and Gen. Mgr., The Fellows Gear Shaper Co., Springfield, Vt., in his keynote address.

American ingenuity was responsible for perfecting the aluminum bearing alloy introduced in Europe for Diesel engines, said Lewis Sandler, Exec. Vice-Pres., Johnson Bronze Co., Newcastle, Pa., in a lecture devoted to the qualifications, casting and machining problems encountered in the application of this recent development.

Proper consideration of capacity, scant lubrication, relation of improved surface finishes to high speed in bearings, design, and engineering principles were all included in the talk, "Bearing Selection," given by F. E. Ericson, Vice-Pres., Barden Corp., Danbury, Conn.

Reduction of the high percentage of production time now spent in wasteful manual methods of handling materials was emphasized by E. J. Burnell, Director and Vice-Pres. in Charge of Sales, Link-Belt Co., Chicago, Ill.; C. A. Litzler, Pres., Industrial Ovens, Inc., Cleveland, Ohio; H. H. Dasey, Pres., Visual Production Planning, Inc., Pittsburgh, Pa.; P. R. Minich, Sales Mgr., Rack Engineering Co., Pittsburgh, Pa.; and T. N. Parlon, Asso. Director of Field Activities for The Yale & Towne Mfg. Co., Philadelphia Div.

Welding was stressed as another economy tool in making and machining special tools, jigs and fixtures, during a symposium sponsored by General Electric Co. and presented by J. E. Anderson, Asst. to Works Manager, Lynn River Works; D. W. Puffer, Welding Section,

Below—Upper left: H. E. Linsley (left) presents his session speakers to Vice-President I. F. Holland. From left: J. E. Anderson, E. H. Girardot, (Mr. Holland), and D. W. Puffer. Center: Dr. W. T. Alexander discusses professional advancement of tool engineers. At left, Dr. Mark Ellingson, who pleaded for more specialized engineering training, and Prof. H. F. Owen who conducted educational session. Right: Interested tool engineers crowd around E. W. Drescher as he sets up display of watch parts to illustrate his lecture. Lower: This audience came from far and near to learn about new techniques in making better goods for less

Top left: C. R. Burt, Niles-Bement-Pond head, tells banquet guests hard work is necessary for a balanced national economy. Center: W. A. Dawson (right) emphasizes a point in conversation with other officers during banquet reception. From left: V. H. Ericson, G. C. Johnson, H. F. Volz and I. F. Holland. Right: H. L. Tigges, Tell Berna and H. H. Pease, Natl. Machine Tool Builders Asso. executives, have time for a bit of shop talk before going in to dinner. Below: Society officers entertain distinguished guests at the speakers' table. From left: W. A. Dawson, Natl. Secy.; H. E. Collins, Director; J. X. Ryneska, Convention Chm.; T. J. Donovan, Director; G. C. Johnson, 3rd V.-Pres.; A. M. Sargent, Director; I. F. Holland, 1st V.-Pres.; H. H. Pease, Pres., N.M.T.B.A.; W. B. Peirce, Pres.; Mr. Burt, honor guest; H. E. Conrad, Exec. Secy.; R. B. Douglas, 2nd V.-Pres.; C. W. Simpson, Exec. V.-Pres., Natl. Acme Co.; H. L. Tigges, C. B. Cole, K. L. Bues and G. S. Wilcox, Jr., Directors; and V. H. Ericson, National Treasurer of the Society

BANQUET

Lynn, Mass.; and E. H. Girardot, Foreman of Tool Design Section, Schenectady, N. Y.

Educators in three phases of engineering training discussed the advancement of tool engineering as a profession, more specialized curricula in institutions of higher learning, and industry's willingness to cooperate through work programs corresponding to Society-approved degree courses in recognized colleges, before a meeting conducted by the National Education Committee.

The speakers were, respectively: W. T. Alexander, Dean of Engineering, Northeastern University, Boston, Mass.; Dr. Mark Ellingson, Pres., Rochester Institute of Technology, Rochester, N. Y. The paper prepared by W. D. Merrifield, Asst. Director in Charge of Technical Training, Chrysler Corp., Detroit, Mich., was read in his absence occasioned by illness.

Highlighting the papers of nearly all participants in the technical program was tribute to tool engineers in keeping abreast of the machine tool field with improvements in accuracy of tooling and gaging, and an appeal for further technical progress to save industry from its present dilemma of conflicting problems.

* * *

An ASTE member prominent in the machine tool industry was principal speaker and guest of honor at the banquet Saturday evening.

Clayton R. Burt, Chairman of the Board, Niles-Bement-Pond Co., West Hartford, Conn., reminiscing over his 50 years in industry, compared costs of materials, labor and products at the turn of the century with the present, pointing plus technical improvements, made pos-

Experience gained the hard way in producing weapons for World War I, sible four to 10 times more production for the second world conflict, he declared, adding that developments in the past ten years, as demonstrated at the recent Machine Tool Show, exceed those of the previous half century.

The old time standard of an honest day's work will again be respected, Mr. Burt indicated, as he concluded with a challenge for constant progress in putting more goods into the hands of the masses, more tooling advances, preparedness and alertness to preserve the American way of living.

In fulfilling its objectives, ASTE is helping industry solve some of its perplexing problems, President W. B. Pierce emphasized during an address detailing the Society's many activities in disseminating technical knowledge.

Following a program of high caliber professional entertainment, many of the banquet guests enjoyed dancing to the music of a well-known orchestra.

* * *

While most of the delegates were busy attending technical sessions and plant tours, other groups were meeting to plan new and extended Society activities. The Directors elected at the Annual Meeting in Houston convened for the first time, and the Standards, Handbook, Constitution and By-Laws, Membership, Education, Honor Awards/Judicial, and Public Relations Committees conferred.

Two morning programs of technical films permitted less energetic visitors to do their plant tours the easy way.

Gracious and friendly hosts, the Boston convention committeemen remained on duty throughout the convention and shared headquarters with the National Program Committee.

The Public Relations Committee maintained a press room for the convenience of visiting technical editors and local newspapers. Several members of the Detroit Central Office staff assisted in physical arrangements and at the registration desk.

* * *

Ladies attending the convention found ample arrangements had been made for their entertainment. At the W. F. Schrafft plant in Charlestown, they saw how candy is mass produced, and a lecture on china featured a visit to the Paine furniture store. In luxurious drawing room surroundings, Bonwit Teller showed the engineers' wives swank versions of the "new look." They were also guests for broadcasts at two radio stations.

* * *

In charge of the convention program were: R. W. Ford, Chm.; E. W. Baumgardner, 1st V.-Chm.; F. J. Schmitt, 2nd V.-Chm.; J. O. Horne, Secy.; A. A. Nichols, H. E. Linsley and G. A. Rogers of the National Program Committee; and from Boston: J. X. Ryneska, Gen. Chm.; W. W. Young, Asst. Gen. Chm.; W. B. Wells, Accommodations; J. L. deVou, Jr., Arrangements and Meetings; W. F. Jones, Plant Tours; J. F. Topham, Banquet; J. P. Crosby, Social Program.

John Sylvester, Film Arrangements; J. C. Ewer, "Boston Tea Party"; H. J. Richards, Registration; Paul Davis, Publicity; W. E. Winfrey, Reception; R. I. Robbins, Transportation; A. L. Potter, Entertainment; J. N. McHoul, Tickets; H. A. Hudson, Emergency; W. C. Swanson, Records and Reports; J. L. Morosini, Signs; A. J. Leone, Budget, and their committees.

A number of the photographs illustrating this section were made by H. L. Rich, Jr., of the Film Arrangements Committee.

BUSINESS

MEETINGS

Top: Unanimous approval of Directors and Officers greets President Peirce's motion to recess Board meeting for luncheon. From left, seated: I. F. Holland, Mr. Peirce, H. E. Conrad, W. A. Dawson, V. H. Ericson, G. C. Johnson, G. S. Wilcox, Jr., T. J. Donovan, Jr., A. M. Sargent and C. B. Cole. Standing: C. V. Briner, K. L. Bues, H. E. Collins, H. L. Tigges and R. B. Douglas. Center: The National Standards Committee studies proposed data sheets. From left: R. C. Peterson, S. F. Girard, Committee's Central Office Secy.; W. H. Smila, Chm.; E. J. Marasko, G. S. Wilcox, Jr., G. M. McGinley of Boston Chapter Standards Com.; L. B. Bellamy and William Moreland. Bottom: A. H. d'Arcambal, W. H. Smila, F. W. Curtis, J. A. Siegel, Chm., R. M. Lippard, J. R. Weaver and T. B. Carpenter do double duty on Judicial and Honor Awards Committees

Board Reviews Progress

Votes Budget, Pittsburgh and Montreal Conventions

IN A THREE-DAY session, the ASTE Board of Directors voted a reduced annual budget, accepted Chapter invitations for two forthcoming national conventions, considered plans for the 1948 Exposition in Cleveland, and elected a Nominating Committee, in addition to acting on reports of National Officers and Committee Chairmen and transacting miscellaneous business listed on the lengthy agenda.

The meeting was conducted by W. B. Peirce, Society President and Chairman of the Board, assisted by Vice-Presidents I. F. Holland, R. B. Douglas and G. C. Johnson, who presided during the presentation and disposition of reports of committees under their direction.

Uncertain economic prospects and overexpenditures in some departments of the organization during the current year led Finance Chairman G. A. Goodwin to urge extreme prudence in Society commitments. After careful study of each item, the Board finally approved an overall budget figure considerably lower than the 1947 appropriation.

* * *

Presentations from Pittsburgh and Montreal, offering hospitality and facilities for the 1949 Annual and Semi-Annual Meetings, respectively, were accepted.

Plans for the Cleveland 1948 Exposition, presented by Chairman C. V. Briner, emphasized housing arrangements. Applications are to be screened by the Central Office to insure preference for members, and reservations coordinated for maximum accommodation of visitors.

Fifty percent of the exhibit space, Mr. Briner estimated, was already sold, [60% at press time] with interest high among both former and prospective exhibitors.

Elected to the Annual Nominating Committee to draw up a slate of 1948-49 directoral candidates are: W. W. Appleton (Toronto), F. J. Dawless (New Haven), W. J. Gamble (Buffalo-Niagara Frontier), A. M. Sargent (Detroit) and F. J. Schmitt (Chicago).

* * *

An important step was the establishment of a fund towards purchase or construction of permanent Society headquarters, as proposed by A. M. Sargent, Special Housing Committee Chairman. In view of his investigations, he recommended maintaining present offices until real estate conditions are more favorable, and submitted plans and quotations for the type of building required by the Society's expanding activities.

R. H. Morris, Building Fund Chairman, recommended earmarking a portion of the Cleveland Exposition proceeds for this project and suggested that any contributions from members be as gifts of books, furniture, decorations or landscaping.

Other contingency reserves were set up by the Board for the Cleveland Exposition and *The Tool Engineer*.

Nearly all of the 1800 pages of the "Tool Engineers' Handbook" are ready for typesetting, according to E. W. Ernst, Handbook Chairman. Unless publishing delays are experienced, the first edition of this valuable reference work will be available to visitors at the Cleveland Exposition next March.

The Committee was authorized to handle sales of the book and to retain Editor Frank W. Wilson to begin work on the first revision of the manual.

* * *

A gratifying number of members have volunteered to work on the newly inaugurated standardization program of the National Standards Committee, Chairman W. H. Smila told the Board.

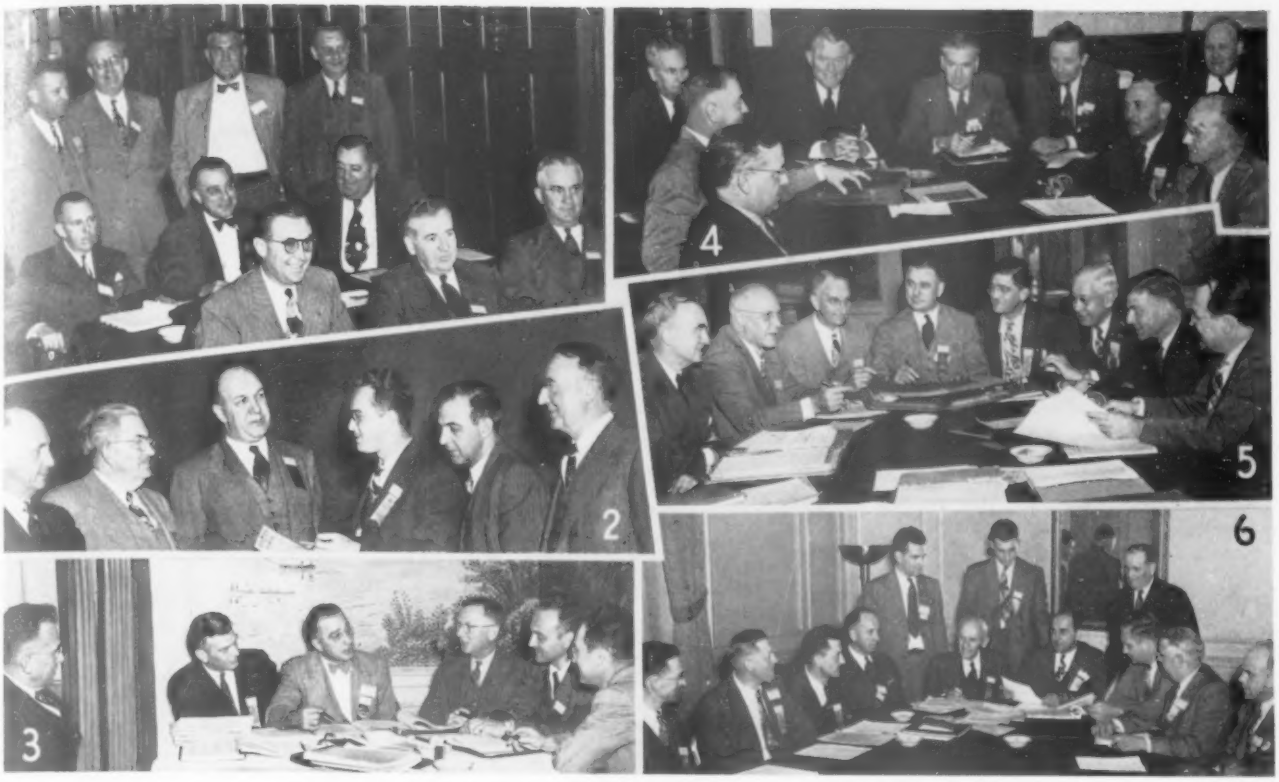
The Data Sheet Sub-Committee has material from 55 manufacturers in preparation, with 70 sheets expected from one company alone, and the Canadian National Standards Committee has data sheets ready for printing and distribution to members in that country.

Extensive additions to tool engineering curricula have been made at leading universities and technical institutes, Education Chairman O. W. Winter's report showed. Experimental work on visual aids will be extended for use in teaching tool engineering courses. Results of a new book review will be published in *The Tool Engineer*.

Over half of the first edition of the "Elementary Jig and Fixture Design" text has been sold and another printing is expected. A new brochure describing the three-section book is to be sent to the entire membership.

Student and Junior member groups may be formed in conjunction with established ASTE Chapters, under the direction of Chapter Education Committees. Such groups may meet individually at school or plant and participate in Senior member meetings.

Definite steps toward achieving its goal of assisting Chapters to obtain high caliber speakers have been taken by the



1. National Committee Chairmen attended Board meeting to present their reports. Seated, first row, from left: R. W. Ford, Program Chm.; H. F. Volz, Membership Chm.; J. A. Siegel, Judicial/Honor Awards Chm.; second row: G. A. Goodwin, Finance Chm.; J. J. Demuth, Constitution and By-Laws Chm.; and W. B. McClellan, Editorial Chm.; Standing: Past Presidents T. B. Carpenter, A. H. d'Arcambal, R. H. Morris, Building Fund Chm.; and W. H. Smila, Standards Chm. 2. The Public Relations Committee considers suggested publicity piece for the Cleveland Exposition. From left: Guy Hubbard, H. E. Campbell, R. E. Crawford, Dr. H. B. Osborn, Jr.; Chm.; J. M. Cannon, Public Relations Director; and W. J. Gamble. 3. J. J. Demuth clarifies a point in Society procedure during meeting of Constitution and By-Laws Committee. From left: P. A. Rickrode, R. B. Douglas, (Mr. Demuth), E. J. Berry, D. R. Linch and A. R. Gieringer. 4. The Membership Committee hears E. W. Dickett's idea for attracting quality members. From left: (Mr. Dickett), M. M. Ross, H. D. Mozeen, F. J. Dawless, H. F. Volz, Chm., J. O. Knight, W. W. Appleton, C. J. Lindegren and H. A. Bachman. 5. The manuscript which O. E. Koehler, Ch. Engr., Greenfield Tap & Die Co. has just delivered to the Handbook Committee is discussed. From left: A. L. Potter, F. W. Curtis, Mr. Koehler, E. W. Ernst, Chm.; F. W. Wilson, Editor; Frank Martindell, R. B. Douglas and B. C. Brosheer. 6. Education Chairman O. W. Winter calls for a report from one of his sub-committeemen. From left: C. D. Wright, A. C. Arends, J. N. Edmondson, F. M. Crayton; (standing)—J. I. Karash, visitors R. W. Bayless and C. T. Morey; C. C. Gorham, Mr. Winter, Richard Kipers, S. B. Hagberg and M. L. Roessel. New and extended activities were planned by committees, to serve members and industry

National Program Committee, Chairman R. W. Ford stated.

Chapters have been divided into nine regions with a member of the Committee assigned as advisor to each. All Chapters have been surveyed concerning their program problems. The Committee plans assistance in arranging speaker tours, more personal contact, and improvement in the mechanics of assembling and disseminating both Chapter and national program material.

* * *

An increased number of subscriptions to *The Tool Engineer*, higher publishing costs and sustained advertising schedules were reported by National Editorial Chairman W. B. McClellan. The *ASTE News* section is being enlarged to meet popular demand, Mr. McClellan added.

H. L. Tigges of Toledo resigned from the Committee on taking office as Director, but will serve in an advisory capacity.

In order to meet the membership campaign goal set by President Peirce, an increase of 28% must be realized by March, H. F. Volz, National Membership Chairman, declared.

Details of the long-range membership drive and promotional material being used were described by Mr. Volz. The National Committee will assist Chapters in reaching their quotas, he said.

One new Chapter has been chartered at Denver, Col., since the Annual Meeting and considerable progress has been made at London, Ont., towards the formation of an ASTE group. Other cities where interest in ASTE is mounting are Chattanooga and Memphis, Tenn.; Eau Claire, Wis.; Sherbrooke, Que.; and Tulsa, Okla.

* * *

Through editorials and special articles in *The Tool Engineer* and other periodicals, news releases and radio broadcasts, the Public Relations Committee is making known the Society's aims and achievements, H. B. Osborn, Jr., Chairman, advised the Board.

A definition of "tool engineering" is expected in the next edition of Webster's Unabridged Dictionary, and preliminary arrangements have been made for a section in the new Encyclopedia Britannica.

Constitutions and by-laws of technical society councils in various cities are being studied for approved Chapter affiliation.

New appointments to the Committee include: Guy Hubbard, Machine Tool Editor, *Steel;* C. C. Harrington, Editor, *Mill and Factory;* W. F. Sherman, Technical Advisor, Automobile Mfrs. Assoc., and C. O. Herb, Editor, *Machinery*.

The Judicial Committee, whose personnel of former presidents also constitutes the Honor Awards Committee, was granted permission to organize the fraternal association of past presidents requested by Chairman J. A. Siegel.

Progress was reported on the establishment of an Eli Whitney shrine, an undertaking initiated by New Haven Chapter. It is hoped that a museum and engineering society meeting place may be located in buildings on the site of the inventor's shop.

In a thoughtfully prepared report, Constitution and By-Laws Chairman J. J. Demuth recommended changes in voting procedures in the House of Delegates and other revisions of the Constitution and By-Laws, all of which were acted upon by the Board.

Resolutions submitted by the last House of Delegates were also considered, as well as a new design for a Past Chairman's pin.

* * *

In addition to the National Committee Chairmen, the President and Vice-Presidents, W. A. Dawson, National Secretary, V. H. Ericson, National Treasurer, and H. E. Conrad, Executive Secretary, reported on their official activities since the Annual Meeting at Houston last March.

At the opening of the meeting, the oath of office was administered by President Peirce to incoming Directors C. V. Briner, K. L. Bues, T. J. Donovan, Jr., and H. L. Tigges.

As Seen in New England

Production Viewed in Private and Government Shops

PLANT TOURS

LIKE SAILORS on shore leave, riding swanboats in the Boston Public Garden, ASTE convention goers seized the opportunity to see how the other fellow does things, more than 400 visiting the several plants holding open house for the Society.

And tool engineers must be nautically minded, too, for the trips to the U.S. Naval Shipyard at Charlestown, where the Navy makes all its anchor chain and rope, were among the most popular.

One center of interest in the navy yard shops was a three-bladed, six-ton, destroyer propeller of face-milled bronze, so perfectly balanced that it turned with a flip of the finger. Other propellers being fabricated included four-bladed types for auxiliary craft.

Largest in New England, a giant planer with a 40-foot table on which a huge lathe rested was another impressive highlight. On this 80-foot machine, the Navy builds engine foundations.

In the forge, mighty presses were pounding glowing steel into male and female parts of weldless, die lock links. Under the 10,000-pound hammer of a press dubbed "Big Barney," the 50-lb. links were forged together to form chain for warship anchors.

Chains with links weighing as much as 158 pounds are tried for strength in a testing machine capable of exerting 2,000,000 lbs. pull.

At the rope plant, the engineers first watched heaps of satiny hemp mechanically twisted and retwisted into cordage of various sizes; then traversed the 200-fathom "Rope Walk" where ropes of the largest circumference are made.

A bit of history was injected into the tour when naval officers conducted the visitors over the gallant frigate *Constitution*, back from the wars, rebuilt, and permanently moored in the city of her birth.

Moving along the gun deck, hunched over to avoid the low beams, one wondered if a crew of pygmies had manned "Old Ironsides," and how War of 1812 navy men slept doubled up in the five-foot berths.

Man's progress in ridding himself of manual toil was brought home once more in a recital of the amount of manpower required to operate the old sailing vessel's guns and capstan.

* * *

Two bus loads of engineers visiting the General Electric River Works at West Lynn were greeted by J. X. Ryneska, Boston Chapter Chairman and General Convention Chairman, in behalf of the G.E. management.

W. E. Trask and Salvatore Gianino, Plant Tour Committeemen, with a staff of 14 guides, escorted the group through the several manufacturing divisions.

Large scale operations commanding enthusiastic interest included steam turbines, cast iron foundry, welded fabrication, large gears, A.C. motors, presswork, and a ceilometer and lighting exhibit.

At Pneumatic Scale Corp. another party examined a large display of complex packaging machinery ready for shipment. A newly completed addition to the plant was included in the tour of tooling and fabricating departments.

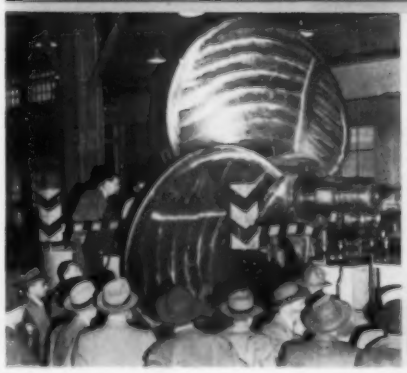
Nearly 125 delegates, who accepted an invitation to inspect the entire facilities of Massachusetts Institute of Technology, were impressed with the size and extent of this outstanding educational institution. Highlighting the tour of its many laboratories were demonstrations of the differential analyzer, materials testing methods, and the textile testing laboratory.

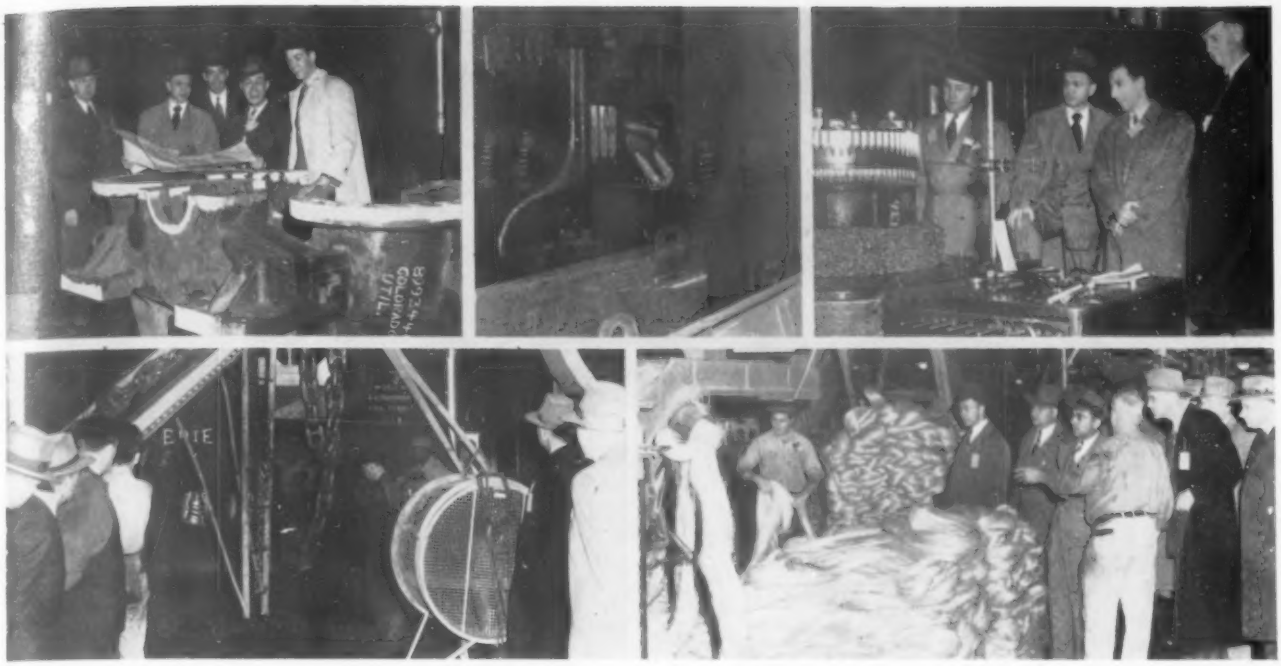
* * *

Those fortunate enough to choose the trip to Worcester Pressed Steel Co. found an unexpected pleasure in the company's museum, housing in appropriate architectural surroundings steel products made through the ages.

A complete collection of ancient and medieval armor, including utensils, tools and products of our predecessors, the armorers, fills the Ancient Wing. In the modern section, masterpieces of hand-wrought decorative accessories and ma-

Below—Upper left: An officer of the frigate *Constitution* vividly describes how a 13-man gun crew fired the 32-lb. carronades discharging missiles with a range of 400 yards. Right: Top drawing card among plant tours was the trip to Massachusetts Institute of Technology, destination of these engineers. Lower left: This six-ton, bronze, destroyer propeller on balancing machine was center of interest at Navy Yard. Center: After debarking from the undefeated "Old Ironsides," a group of members pauses to look over her sister ship, the *Constellation*, tied up alongside. Right: This vista of armor used through the ages presented itself to visitors entering the Ancient Wing of the Worcester Pressed Steel Co.'s museum of craftsmanship in steel utilitarian products and decorative objects from early metalworking times to the modern mechanical age





chine made precision products express correlation between harmony of proportion and efficiency of function that transcends surface beauty.

Specializing in the manufacture of stampings and cold rolled strip steel, the plant proper combines high speed, powerful machines operating at peak efficiency, with accurate inspection methods, to maintain its low rejection record of 1%.

Among other plants, sponsoring similar educational tours were: Chelsea Clock Co., W. H. Nichols Co., Ford Motor Co., Boston Gear Works, and Simonds Saw & Steel Co.

Top—Upper left: Salvatore Gianino, Walter Jones and J. X. Ryneska show lower half of exhaust casing of 10-ft. radial drill at Turbine Div. of General Electric River Works, W. Lynn. Visitors at right are: Fred Pillsbury, Irwin Shumaier and Frank Hatton of St. Louis. Center: A section of die lock weldless anchor chain is removed from die forging press at the Navy Yard. Right: Gear hobbing in the G. E. Gear Plant Div. interests A. R. Gieringer, Milwaukee; J. X. Ryneska, G. E. executive serving as guide; Reginald Byron, Montreal; and T. H. C. Allison, Toronto. Lower left: An ever-lengthening anchor chain of 50-lb. links emerges from this Navy Yard press. Right: A foreman in the rope works explains how these strands of glossy hemp are made into stout ropes for naval vessels. Below—Upper left: The drawing of a large stainless steel shape is performed in a 600-ton double-action Toggle press before visitors at Worcester Pressed Steel Co. In the group are: R. B. Andrews, W. L. Harper, T. J. Killelea, D. E. Makepeace, H. C. Spooner, L. A. Hart, K. L., and E. McLeod. Right: Delegation to Boston Gear Works, from left, front row: C. J. Davidson, Endicott, N. Y.; J. I. Eyer, Schenectady, N. Y.; F. J. McMillen, Providence, R. I.; and R. B. Smith, New York City. Second row: F. W. Walker, Arlington, Va.; H. L. Davis, Watertown, Mass.; H. A. Junkins, Boston, Mass.; M. A. Radecki, New Haven, Conn.; and J. C. Ellis, Syracuse, N. Y. Rear row: E. Pickener, Watertown, Mass.; F. Ryan, Chester, Vt.; D. F. Saurenman and H. Briggs, Houston, Texas; B. W. Didsbury, Ansonia, Conn.; H. G. Nordquist, N. Arlington, N. J.; and E. R. Olin, Braintree, Mass. Lower left: Richard Ripley, Clarence Ripley and E. R. Arvidon listen to inspection procedure being explained by M. Ahern of the W. H. Nichols Co. staff. Center: A testing device is demonstrated in the Strength of Materials Laboratory at M.I.T. Right: Milling operation is described for J. R. Osterlund, John Lindegren, Jr., and Andrew Lachner by W. H. Nichols Co. workman. Guide at left is A. Aldrich, another employee of the Nichols Co.

Chrysler Corp. of Canada executives were recent guests of Windsor Chapter when Harry G. Moock, Vice-President of the Plymouth Div., addressed the ASTE group. From left: E. C. Row, V.-Pres. and Gen. Mgr.; R. T. Richards, Chapter Chm.; Mr. Moock, Kenneth Crittenden, V.-Pres. and Gen. Operating Mgr.; and G. F. Smith, Factory Mgr.

Industry Must Advance Man Socially, Says Researcher

Kansas City, Mo.—Industry must become more conscious of its responsibility to and of the impact of its operations upon the social structure, according to Dr. D. O. Dohrenwend of the Midwest Research Institute here.

Speaking on "Research in Industry" before Kansas City Chapter members at their October meeting, Dr. Dohrenwend declared that the main reason for the existence of any industry is to serve mankind, not to make money. A successful industry will best serve humanity by adding to its social advancement as well as in developing material things for its use and convenience.

Failed to Utilize Knowledge

Engineers, he continued, originally charged with directing the forces of nature to the service of man, did not make full use of the knowledge available. Thus, the desire for greater industrial advancements on the part of those who conduct manufacturing activities has led to the establishment of industrial research departments to bridge the ever-widening gap between scientific knowledge on the one hand and its application on the other.

Little if any real difference exists, in Dr. Dohrenwend's opinion, between engineering in its broad sense and industrial research, except that the latter works much more closely with science and must include the application of all human knowledge to industrial problems.

In general, he explained, the engineer has not been able to cope with the new complexities of industrial problems and rapid developments in the newer fields of science. A keener appreciation of science was needed as the scientist and engineer drifted apart. Industrial research was the answer.

Greatly expanded since its inception less than 50 years ago, industrial research the speaker cited as now employing nearly 135,000 workers in 2,790 laboratories at an annual normal expenditure of almost $1 billion.

Research groups, outside of company laboratories, Dr. Dohrenwend classified as: (a) organizations of a given industry that pool their research funds to form foundations; (b) organizations that undertake the training of personnel along with their research work; and (c) independent organizations set up to operate on a non-profit basis for the good of industry.

Services available to industry through the third group were defined as: (1) purchase of a single project by a small company with no research facilities; (2) commission, by a medium-sized company with a small specialized laboratory staff, of a research project requiring specialized knowledge and equipment not found in their own facilities; and (3) investigations for a large company with extensive laboratories, to check their own results and to diversify and stimulate interests in their own laboratory staff through contacts with outside scientists and engineers.

In outlining the operations of non-profit research institutions, Dr. Dohrenwend pointed out that their productiveness is measured entirely by the "batting average" on difficult research problems.

During the next 10 years, he predicted, industrial research is likely to double in activity.

Textile Machine Plant Host for Tour, Dinner

Rockford, Ill.—Rockford Chapter members were guests of Barber-Colman Co. for their November 6 dinner meeting.

Preceding dinner, a trip was made through the textile division to view the many machines with which Barber-Colman serves the woven fabric field.

Following dinner in the company cafeteria, George C. Johnson, Third Vice-President of ASTE, gave a resume of the Society's recent Semi-Annual Meeting.

Clare Bryan, Consulting Tool Engineer of Link-Belt Co., Chicago, gave an illustrated lecture on "Practical Engineering of Jigs and Fixtures."

Mr. Bryan's slides illustrated the many new applications of jigs, fixtures and special machine tools recently installed in his company's plants.

T. E. Needs Salesmanship To Put Proposals Across

Windsor, Ont.—Tips on "Salesmanship in Tool Engineering" were given Windsor Chapter members by Harry G. Moock, Vice-President of Plymouth Div., and Managing Director of the Conference of Business Management, Chrysler Corp., in an address October 13 at the Prince Edward Hotel.

Citing occasions when sound ideas had come to naught through failure to present them intelligently and succinctly, Mr. Moock stressed the importance of gaining a favorable ear to any proposal and following up with the advantages of the proposed plan or idea.

R. T. Richards, Chapter Chairman, in his opening remarks on the occasion of Canada's Thanksgiving Day, expressed the hope that tool engineers would never again be called upon to use their talents in manufacturing tools of war, but rather that they might be allowed to exert all their efforts towards building a permanent peace.

Guests included Chrysler Corp. of Canada officials: E. C. Row, Vice-President and General Manager; Kenneth Crittenden, Vice-President and General Operating Manager, and G. F. Smith, Factory Manager.

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Tapping Refined to Meet Aircraft Makers' Demands

Chicago, Ill.—The aircraft industry's demand for Class 3 and 4 fits gave impetus to the development of proper tapping equipment, according to Herman Goldberg, President of Snow Mfg. Co. and self-styled "rough mechanic."

Mr. Goldberg was the principal speaker at a dinner meeting of approximately 150 members and guests of Chicago Chapter, October 13, in the Furniture Club of America.

Class 4 tapping, the speaker indicated, is now being done on a commercial basis. Ninety-five percent of tap breakage, he charged, results from using the wrong style of tap. And most taps break when backing out—the tap loads with metal pickup and welds, then seizes, and breakage occurs.

Most important factors in tapping, in the order of their importance, were listed by the speaker as: (1) the cutting tool (tap), (2) cutting oil, (3) fixture method of holding and support, and (4) machine. With the proper tapping method, as many as 60,000 holes per sharpening have been obtained, he added.

All of the points considered were illustrated by actual tapping demonstrations on a machine and with samples.

Prior to the technical discussion, Frank Martindell of the Teletype Corp., and a Chapter member, spoke on "Tool Engineering, an Art and Profession," from an aesthetic standpoint.

Discusses Machineability

Elmira, N. Y.—Carl J. Oxford, Chief Engineer, National Twist Drill & Tool Co., was guest speaker at the October 6 dinner meeting of Elmira Chapter.

Mr. Oxford's subject, "Machineability —The Practical Aspects of Metal Cutting," was augmented by lantern slides showing various drills and cutting tools.

A motion picture travelogue of western United States followed the technical talk.

Chairman Edward Stachel opened the business meeting and First Vice-Chairman James Deegan introduced the speaker. About 50 members and guests were in attendance.

Multitude of Questions Follows 'Grinding' Talks

Rochester, N. Y.—Richard Moore, President, and Fred Victory, Chief Engineer of the Moore Special Tool Co., Inc., Bridgeport, Conn., collaborated in a novel presentation of grinding problems and their solutions before 125 members and guests of Rochester Chapter, meeting October 6 at Rochester Institute of Technology.

Mr. Moore's subject was "Grind It" and Mr. Victory's, "Machines to Grind It." The former took the part of the toolmaker and presented a number of difficult grinding problems to his associate for logical solution.

Mr. Victory discussed each of these problems in turn, explaining how such a job could be done and the best type of equipment suited for the particular operation. He talked also at length on crush form grinding and its importance in building lamination dies.

After their talks, both speakers were bombarded with a multitude of questions on all phases of grinding. These they answered clearly and in detail to the complete satisfaction of all concerned.

Chairman Milton Roessel presided and Past Chairman Earl DeBisschop introduced the speakers. Robert Barnett, Program Chairman, announced the programs to be presented for the remainder of the season.

Haynes Advanced at Spicer

Toledo, Ohio—Promotion of Robert B. Haynes to the newly-created position of Works Manager at Spicer Manufacturing Div. of Dana Corp. in Toledo has been announced by R. E. Carpenter, Executive Vice-President of the corporation.

With Spicer since 1935, Mr. Haynes first worked on special assignments, then became master mechanic and in recent years has served as equipment manager.

Before joining Spicer he was associated with a number of mid-west manufacturers, and in 1931 he went to Russia as technical representative to supervise the creation of a factory in Moscow for the manufacture of automotive electrical equipment. He is a member of Toledo Chapter, ASTE.

Chrome Cavity Molds Cut Costs of Precision Parts

Toronto, Ont.—Speaking before a capacity audience, Charles E. Dawson, Plastics Consultant for the Stainless Cavity Corp., Leominster, Mass., discussed modern methods of producing long life cavity molds for the reproduction of precision parts.

Using Perry castings, he emphasized, costs can be cut through the resultant reduction in skilled labor.

The Perry casting, produced from Perry chrome by means of a wooden pattern, the speaker explained, reproduces in turn a metal component of the part to be duplicated. After this component is thoroughly checked for size, a permanent casting is made for long runs.

The audience was highly interested in methods outlined by Mr. Dawson, and the question and answer period brought on a lively discussion.

Presiding over the meeting, Chairman L. M. Jardine spoke briefly on the Machine Tool Show at Chicago, then called on Past Chairman Walter Appleton to describe the show for the benefit of those who could not attend.

John W. Lengbridge, Education Chairman, outlined an extensive program for the winter months.

R. E. Raaflaub, Chapter member and Machine Shop Instructor at Ontario Reform School, Brampton, Ont., told about the boys under his care, pointing out that these youths must have the cooperation of industry if they are to make good on their return to private life.

A generous response from executives able to place these boys followed Mr. Raaflaub's talk.

Asserts Casting Designer Needs Aid of Foundryman

Atlanta, Ga.—Thomas H. Cox, President and Manager of Currahee Foundry and Manufacturing Co., Inc., Toccoa, Ga., was the featured speaker at a dinner meeting of Atlanta Chapter held October 20 in Georgia Tech Banquet Hall. His subject was "Modern Foundry Practice."

After touching briefly on the history of the foundry in this country, Mr. Cox explained various processes necessary to produce castings. He stated emphatically that in order to make good castings at the lowest cost, the designer should consult the foundryman or someone with foundry experience, concerning possible methods of casting, gating, elimination of cores and other expensive pattern features.

Some of the lesser known phases of foundry processes, such as investment molds and centrifugal casting were also discussed.

Following his talk, Mr. Cox answered many questions from the audience, using blackboard diagrams for illustration.

Through the courtesy of The DoALL Co., Des Plaines, Ill., two films were shown depicting machine operations in the sawing and filing of an irregular contour die.

Left: Herman Goldberg of Snow Mfg. Co. directs a tapping demonstration during his lecture before Chicago Chapter members. Right: Frank Martindell of Teletype Corp. addresses his fellow members concerning professional aspects of tool engineering. From left: F. J. Schmitt, Chm., Mr. Martindell and T. C. Barber, Membership Chm.

Small Plant Not Adapted To Statistical Control

San Francisco, Calif.—Statistical control methods are beyond the range of the smaller manufacturing concerns, E. J. Raves, Plant Superintendent of Grove Regulator Co. in Oakland, and a Past Chairman of Golden Gate Chapter, stressed in an address, "Manufacturing Inspection Procedures," delivered to his fellow members October 21 in the El Curtola Cafe, Oakland.

The floor inspector, Mr. Raves stated, can exercise a powerful influence on an operator's production in serving as a helper rather than a policeman. The operator soon comes to depend on the floor inspector and, through coooperation, piece production is increased and scrap reduced.

Proper inspection gages minimize gaging time and orderly stacking of parts makes progressive spot checking possible, the floor inspector making regular rounds of the machines.

An inspector, the speaker continued, should have a background in all phases of shop work, if he is to do other than routine inspection. Assembly work is of particular value in demonstrating the use of interchangeable parts.

Unilateral tolerance, Mr. Raves indicated, should appear on all drawings—that is all holes should have the tolerance given on the plus side, while tolerances for shafts should be shown on the minus side, facilitating calculations in borderline cases.

R.M.S. standard designations were recommended to eliminate the ambiguity usually present in finish marks on drawings in the smaller shops.

After the lecture an open discussion was conducted around a table where production gaging equipment was displayed.

During the coffee period, Inspector John Baker of the Oakland Police Department related, in a very entertaining and realistic manner, experiences in dealing with crime and violence.

Past Chairman Walter Kassebohm, General Manager of Production Engineering Co., Berkeley, reported on the Machine Tool Show at Chicago. Comparing production over the years, he pointed out that tool design and machine tool design have been the keynote of the tremendous progress made.

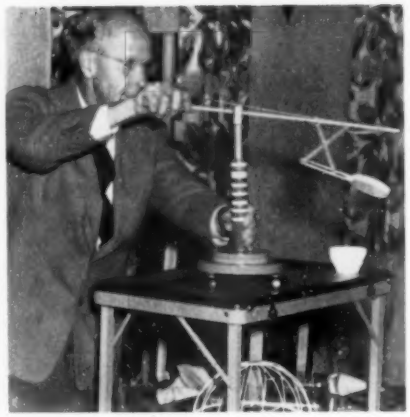
ASM-ASTE Group Inspect Molybdenum Mine, Plant

Denver, Colo.—The mills and mine of the Climax Molybdenum Co. at Climax were recently inspected by a joint group of Rocky Mountain Chapter, ASM, and Denver Chapter ASTE, members.

After arrival at the mine, the visitors were luncheon guests in the company's dining room.

The party was then escorted about in small groups and had opportunity to see the flotation process used in extracting ore from the rock.

On the return trip, dinner was served at Wildwood Lodge.



Doughnut dunking can be dripless, according to "Professor" Russell E. Oakes, the "Wizard of Waukesha," inventor of this ingenious gadget which he demonstrates for amusement of Flint Chapter members and guests

Iverson Offers Solutions To Broaching Problems

Madison, Wis.—A large and interested group of Madison Chapter members heard Norman H. Iverson, Chief Engineer of Michigan Broach Co., Detroit, discuss "Broaches and Broaching" at a dinner and technical session, November 4, in the Loraine Hotel.

Mr. Iverson outlined briefly early developments in the process, leading gradually into the present advanced science that broaching has become. Among other things, certain difficult broaching operations and methods of procedure were mentioned.

Blackboard sketches, samples of broaching, and a film, "Broaching in the Plant," illustrated the talk.

At the conclusion of the lecture, Mr. Iverson conducted an animated question period.

Following the technical program, another film, "The Alaskan Highway," was shown through the courtesy of Allis-Chalmers Mfg. Co. and at the request of the membership.

Multiple Tooling Methods Highlight Presswork Talk

Hamilton, Ont.—William W. Schug, Vice-President and Sales Manager of The V & O Press Co., Inc., Hudson, N. Y., presented the technical program at a meeting of Hamilton Chapter, October 9, in Fischer's Hotel.

In treating his subject, "Presses Geared for Automatic Production," Mr. Schug traced the development of the punch press from early days and demonstrated with slides various multiple tooling procedures. The automatic operations with proper tooling for presswork highlighted his talk.

After the lecture, the speaker explained tooling methods used to produce samples displayed.

Gordon Hall, First Vice-Chairman, introduced the speaker and William Shaw thanked him. Approximately 60 members were present.

"Professor" Demonstrates Laugh-Getting Inventions

Flint, Mich. — Russell E. Oakes, the "Wizard of Waukesha," entertained Flint Chapter recently with a talk and demonstration of "Progress in Science and Invention." "Professor" Oakes spoke at a dinner meeting held in Frankenmuth, attended by 150 members, guests and their ladies.

The "Professor" demonstrated his many goofy inventions to an amused and appreciative audience. He pointed out that while eating is one of our most popular indoor sports, there is room for much improvement in our methods.

Most people have difficulty in wrapping spaghetti around a fork—there is always a loose end. The "Professor" has made this a simple operation by ingenious adaptation of an egg beater.

Eating peas has long been troublesome. They roll off the knife. "Professor" Oakes has an answer to this problem.

The infamous habit of dunking doughnuts and its many hazards attracted "Professor" Oakes' attention and he did something about it. He invented the "dripless" doughnut dunker, which permits you to drink in complete safety.

But the "Professor" has not confined himself to improving the art of eating. His inventions also include a self-finding golf ball, a church collection plate, a chatter eliminator for use at the movies, and his crowning achievement, the hydraulic cigarette lighter.

War Dead Repatriation Discussed by Mortician

Akron, Ohio—E. R. Turkel of the Cassidy and Turkel Mortuary in Alliance was the principal speaker at the October dinner meeting of the Rubber City Chapter, held in the Alliance Country Club.

Mr. Turkel made it apparent to his audience that he not only knew his subject, "The Repatriation Project of Casualties of World War II," but that he was also very familiar with the tooling problems overcome in the manufacture of the deep drawn, seamless steel caskets in which our fallen warriors are being brought home from overseas.

The meeting was arranged by Herman Guy, Chapter Chairman and host for the occasion.

Relates Cutting Trends

Cedar Rapids, Iowa—"Trends in Cutter Development" were revealed to Cedar Rapids members by Frank P. Cavenagh of The Warner & Swasey Co., Cleveland, Ohio. Mr. Cavenagh was guest speaker at the Chapter's October 15 meeting.

His talk concerned technical problems and results of testing tool bits at various and extreme speeds to determine the best cutting and relief angles, and life expectancy. A sound film was shown.

Preceding the technical speaker, D. W. Lehti, President, Link-Belt Speeder Corp., traced the "History of the Power Shovel."

Describes Mechanics Of Induction Heating

Chicago, Ill.—Dr. H. B. Osborn, Jr., Director of Research, TOCCO Div. of Ohio Crankshaft Co., gave an illuminating lecture on "Induction Heating" before Chicago Chapter members at a dinner meeting, November 3, in the Furniture Club of America.

Higher bearing pressures on crankshafts, Dr. Osborn began, led to the search for a harder wearing surface. Uniform results could not be obtained by flame hardening because time and heat could not be controlled closely enough.

In the induction heating method, the primary heating comes from the eddy currents and the hysteresis force is negligible. The flow of primary current induces current in the secondary. Due to the high frequency, energy is concentrated on the working surface.

Gives Hardness Formulas

Dr. Osborn gave formulas showing relationship between frequency, and depth of hardness. He discussed also the connection between frequency and diameter of the bar workpiece.

Three methods of producing high frequency, named by the speaker, are by means of: (1) motor generator sets, (2) spark gap oscillators, and (3) vacuum tube oscillators. The economics of the various sizes of induction hardening units was explained.

Many applications were shown in slides. These included an automatic machine to anneal 40,000 bullet shells an hour and illustrations of shell ends being heated for nosing. Several types of motor generator sets were shown, and heating material for forging operations was described, as well as through line heating of screw machine stock.

F. J. Schmitt, Chapter Chairman, presided and reported on the recent Board of Directors meeting at Boston.

Dr. H. B. Osborn, Jr., Director of Research at Tocco Div., Ohio Crankshaft Co., and National Public Relations Chairman of ASTE, explains principles and applications of induction heating to Chicago members

Dr. C. A. Seibert (left) of University of Michigan chats with Joseph Dorjath, Program Committeeman of Detroit Chapter, before the latter introduces him as principal speaker at the Chapter's November meeting

Says Ingenuity Can Win In Production Battle

Pontiac, Mich.—Skilled men and metal shortages are creating a battle of wits, Carl Bock, Chief Engineer of General Motors Corp. Truck and Coach Div., told 125 members and guests of Pontiac Chapter at a dinner meeting in Hotel Pontiac, October 23.

Only by close cooperation between designing and tool engineers can this handicap be overcome, Mr. Bock added. The same ingenuity exhibited during the war years will solve these problems, he indicated.

Two motion pictures were shown after the lecture, followed by a brief business meeting conducted by Chairman Albert Rhodes.

Past Chairman George Bryan was acting toastmaster. Cash Bond, Program Chairman, was assisted by Rex Lawrence, Marcus Scott and Eldon Hall.

Guests included Alex Jacobs, engineer from the General Motors plant in India.

New Society Data Sheets Issued, Suggestions Invited

Detroit, Mich.—The third mailing of ASTE Data Sheets, issued under the new numerical indexing system, has been distributed to the entire Society membership by the National Standards Committee.

The new sheets contain engineering information concerning milling cutters, drills and drilling, reamers and reaming, by the National Twist Drill & Tool Co.; specifications on Bristol Multiple Spline Socket Screws, Bristol Multiple Keys, and the Rockwell Hardness Tester, by The Bristol Co. and Wilson Mechanical Instrument Co., respectively.

The Standards Committee is now developing many additional data sheets to be released to the membership from time to time. The Committee solicits constructive criticism from members relative to the type of data sheet desired, and will welcome suggested names of manufacturers in your area who have products adaptable to ASTE Data Sheets.

Below is a form for your convenience in conveying such information to help your Standards Committee serve you better. No letter required, just slip the completed coupon, expressing your wishes, into an envelope and mail as directed.

I NEED DATA SHEETS PERTAINING TO: .....
Please be specific in listing subjects or products

.....

.....

I SUGGEST that the following manufacturers be invited to sponsor data sheets to assist tool engineers specifying their products:

1. .....
Company Name and Address

2. .....
Product(s)

3. .....
Name and Title of Suggested Contact

1. .....

2. .....

3. .....
Additional names may be listed on another sheet.

Signed .....
Name Address

Chapter Name .....

Tear off and mail to: W. H. Smila, Chairman, National Standards Committee, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Metallurgist Discusses Treatment of Tool Steels

Detroit, Mich.—Some 300 members and guests of Detroit Chapter heard Dr. Clarence A. Seibert, Asso. Professor of Metallurgical Engineering at the University of Michigan, discuss "Metallurgy and the Tool Engineer" at their November meeting.

Dr. Seibert confined his talk to the metallurgy of ferrous metals, augmenting it with slides. Emphasis was placed upon the alloying and heat treatment of tool steels to obtain various qualities of machineability, hardenability, strength, and wear resistance.

Tremendous interest was signified by the many questions directed to Dr. Seibert during the ensuing open discussion.

In the preceding business meeting, Chairman Leslie Bellamy announced the resignation of Second Vice-Chairman William Moreland who has accepted a position in Rockford, Ill. George Koch, incumbent Membership Chairman, was elected to complete Mr. Moreland's unexpired term.

Tool Engineers' Handbook Authors

Biographical Briefs

Carroll R. Alden acquired an extensive academic background before joining the engineering staff of Ex-Cell-O Corp., Detroit, in 1923.

After receiving M.E. and E.E. degrees from Ohio Northern University, he became Dean of Trades and Technical Schools of the Detroit Institute of Technology. Here his M.S. in M.E. was conferred.

Subsequently he became Dean of the College of Engineering at Ohio Northern and, during the first World War, he was a member of the staff of the U.S. Navy School of Steam Engineering.

As Research Engineer at Ex-Cell-O, Mr. Alden has been instrumental in developing the company's precision spindle, as well as their high speed air turbine driven grinding spindle, and bearings for its electronically powered and controlled successor.

He has contributed also to the development of the firm's precision boring machines and the hydraulic controls for their Diesel fuel injection systems on which he did pioneer work.

He is a member of ASME, SAE, and the Engineering Society of Detroit.

* * *

Preparing for publication technical information on honing, keeping field engineers informed of technical and engineering developments, and training new staff members have given **Myron P. Ellis** an accurate perspective of technical data required by tool engineers.

Mr. Ellis, who heads the Field Engineering Service Dept. at Micromatic Hone Corp., Detroit, has been with the company since 1942.

After a year in the Engineering Dept., he was transferred to the sales Dept. He is an engineering graduate of the University of Michigan.

* * *

In his nearly 30 years' association with one firm, **E. L. Hemingway**, Research Engineer for Gisholt Machine Co., Madison, Wis., has worked under three company ownerships.

A quarter of a century ago, Mr. Hemingway was appointed foreman of the Heat Treat Dept. at Foster Machine Co., Elkhart, Ind., later succeeded by the International Detrola Corp.

Six successful years at this post brought him advancement to Chief Matallurgist. Since 1938 he has had charge of research on surface finish, abrasives, and Superfinishing.

When the Detrola machine tool business was sold to Gisholt late in 1945, Mr. Hemingway continued as Research Engineer.

A member of ASM, ASME, and SAE, he is the author of 18 articles on abrasives and surface finishes. He has also lectured on these subjects before local and national meetings of ASM, ASTE, AISE, SAE, and the Westinghouse Forum.

Educated and apprenticed in England, **Herbert S. Indge**, Lapping Development Engineer for Norton Co., Worcester, Mass., left a post as designer and chief inspector of gages and measuring machines to come to America in 1920 at the invitation of Taft-Peirce Mfg. Co. Woonsocket, R.I. While there he completed a two-year special lapping assignment.

As Chief Engineer at Warren Fraser Co. and later at Bethel Player Co., Westboro, Mass., he was concerned with lapping machine development, a field which he has served at Norton Co. for the past 20 years.

E. L. Hemingway

Carroll R. Alden

John Sasso

Herbert S. Indge

C. J. Minnich, Jr.

Willard H. Spence

Myron P. Ellis

Berkeley Williams

In addition to contributing several articles on lapping to the Norton publication, *Grits and Grinds*, Mr. Indge has lectured on lapping and refining of ground surfaces before various chapters of ASTE and ASME, and the Industrial Management Council, Rochester, N.Y.

He is the holder, solely or jointly, of more than 75 patents on lapping machines and devices.

* * *

C. J. Minnich, Jr., entered industry as a member of the industrial engineering staff of the Atlantic Refining Co., after earning his B.S. in Economics at the University of Pennsylvania.

In 1928 with six years' experience in this capacity, he joined Stevenson, Jordan & Harrison, Inc., of New York City, as Senior Staff Engineer.

Since 1940 he has been a partner in the company, supervising surveys and installation of clerical procedures, production control, and standard costs for clients in the machine tool and metal working industries.

John Sasso, a graduate of Columbia School of Engineering, practiced his profession with the Pennsylvania Railroad and the American Radiator Co., working on electrification and controls respectively, before becoming interested in business publications.

In 1938 McGraw-Hill Publishing Co. named him Managing Editor of *Product Engineering*. Last year he became Production Editor of *Business Week*.

He has written numerous technical articles and four books: "Handbook of Mechanical Design," "Plastics for Industrial Use," "Plastics in Practice," and a handbook of plastics for product engineers.

Organizations Mr. Sasso has addressed include: American Chemical Society, American Society of Refrigerating Engineers, Society of the Plastics Engineers, and the Society of the Plastics Industry. He is affiliated with the two latter groups and with SAE.

Willard H. Spence, in charge of Screw Machine Sales and Tooling Applications at Brown & Sharpe Mfg. Co., Providence, R.I., joined his company as an apprentice draftman after attending Rhode Island State College.

Several of the score or more years of this association were spent in the engineering department, in connection with special tooling applications to grinding machines, followed by 10 years' service on patent work.

This culminated in his assuming the direction of patent activity, prior to his present assignment in the sales field.

* * *

Berkeley Williams, Application Engineer in the Bore-Matic Sales Div. of Heald Machine Co., Worcester, Mass., has specialized in this field since 1934.

Earlier, he was employed for several years in sheet metal and rubber thread plants. Another association with a management engineering firm included activity on wage incentives and management applications. He is a graduate M.E.

Chart and Common Sense Expedite Steel Selection

Poughkeepsie, N. Y.—"Factors to Consider in Choosing the Right Steel for the Job" were presented by William J. Conley of Carpenter Steel Co. to 115 members of Mid-Hudson Chapter at the Nelson House, October 14.

Confining his talk to the proper selection of tool steels, Mr. Conley used a 12-square diagram for illustration, each square representing a particular grade of tool steel.

He stressed first, four considerations to insure proper selection and use of tool steels: (1) design; (2) selection; (3) making the tool; and (4) heat treatment. All are important, he said, and failure in any one will defeat the whole program.

Other recommendations made by the speaker were: Design to equalize sections as much as possible; avoid sharp corners. Use the 12-grade diagram and select the best steel for the job. Exercise care in making and finishing the tool to provide proper clearances and strength to withstand heat treatment and to insure long life, especially where production demands are high. Heat treat with knowledge of the steel selected and the use to which it will be subjected.

Four vertical columns of three grades each comprised the 12-grade diagram exhibited by Mr. Conley. From left to right, the columns were headed: Air Hardening Steels, Oil Hardening Steels, Water Hardening Steels, and High Speed Steels. In the top row, horizontally, were wear quality steels; in the second line, normal average use steels, and at the bottom, tough steels.

The speaker advised starting at the center as a first choice. This is a regular .90 carbon steel for average uses, satisfactory, and easy to process. For special requirements, steels chosen from the right or left and from above or below will offer adequate selection, he said.

With a properly prepared chart, good judgment backed by experience will dictate correct selection, he concluded. A discussion following the lecture was ably handled by the speaker.

Chairman John L. Petz presided at the meeting and introduced Mr. Conley.

First Vice-Chairman L. H. Tenney reported briefly on the area meeting conducted by First Vice-President I. F. Holland at Binghamton, October 12.

New members, introduced by Membership Chairman Charles Brownell, included: John X. King and James F. Snyder of International Business Machines Corp.; Herman F. Zorn, William W. Schug and Raymond A. Freeman of V & O Press Co., Hudson, N. Y.; and John J. Young, The DeLaval Separator Co.

A group of St. Louis members gather around Tool Room Foreman Oppeare at Wagner Electric Corp. as he explains a milling operation, during October 9 Chapter tour of the plant when nearly 500 saw factory in actual operation

18,000 Ton Press Forges Large Parts for Aircraft

Springfield, Vt.—The design, construction, installation and operation of an 18,000 ton die forging press at Wyman-Gordon Products Corp., Worcester, Mass., were explained by George W. Motherwell, company works manager, in his lecture, "Large, Light Metal Aircraft Forgings," before 150 members and guests of Twin States Chapter, meeting October 8 in the Colonial Inn at Claremont, N. H.

An authority on the drop forging industry, Mr. Motherwell presented salient points concerning die design and the intricate processes, controls, and inspection procedures required for the maintenance of quality, precision and consistent physical properties in light alloy forgings for the aircraft industry.

His slide-illustrated talk emphasized the magnitude of construction problems encountered in the erection of the largest press and probably the biggest single piece of machinery of any kind in America.

Concluding his address, Mr. Motherwell drew from his vast international experience in many lands to present his views on Americanism. Having lived under Hitler, his inspiring, patriotic message concerning our way of life was punctuated with deadly blows at the collectivism of various foreign governments.

Alan E. Stubbs, Chapter Chairman, announced that the guest speaker for the next meeting, to be held November 12 in Springfield, would be R. E. Small, head of the Aircraft Gas Turbine Div. of General Electric Co., West Lynn, Mass. Mr. Small's subject is "Aircraft Gas Turbines."

The meeting concluded with remarks by V. H. Ericson, National Treasurer.

Apprentices Quizzed

Syracuse, N. Y.—Syracuse Chapter dedicated the first regular meeting of the season on October 14 to tool engineers of the future.

Andrew Troxler, Chapter Education Chairman and Supervisor of Apprentice Training at the Smith Technical School, conducted a quiz program. Participants were 13 students of the school, who responded nobly to Quizmaster Troxler's various technical questions.

Members and guests attending the meeting were impressed by the knowledge and enthusiasm of the youngsters.

Nearly 500 Participate In Electric Plant Tour

St. Louis, Mo.—Nearly 500 members and guests of St. Louis Chapter were visitors at Wagner Electric Corp. for their October 9 meeting.

C. W. Hesse, General Superintendent at Wagner, manufacturers of electric motors, transformers, and automotive and industrial hydraulic brakes, was company host at dinner. Following dinner a business meeting was conducted by Chairman Edward Ruder.

After an address of welcome by Mr. Hesse, Mr. Cecilius, Assistant Plant Engineer, explained the procedure of the tour through the plant. Special arrangements had to be made to accommodate the large group.

The tour began in the small motor department, showing production methods of fractional hp motors, through many interesting processes to the assembly.

The punch press department, hydraulic brake section and the related transformer department with its 1,000,000 volt surge test equipment, the large motor manufacturing section and tool room rounded out the tour.

Many of the departments were active, giving the engineers an opportunity to observe actual work being performed. Operations covered practically all phases of manufacturing methods, including rotor die casting, heat treating, punch press, broaching, milling, boring, drilling, grinding, painting and plating.

At the conclusion of the visit, Chairman Ruder thanked Mr. Hesse and Mr. Cecilius for the company's hospitality.

Overall Standards System Subject of Chapter Award

Cleveland, Ohio—A prize contest, for the best comprehensive paper on an overall standards system, from management's viewpoint, to effectively produce a better product at lower cost, is being offered Cleveland Chapter members under the sponsorship of the Chapter Standards Committee.

The winning manuscript must incorporate answers to the following questions: 1. What type of overall system will produce this result of better products at lower cost? 2. How may such a system be put into practical effect? 3. What would you do first, next and so on to effectuate this system?

Conditions governing the competition are: 1. Single prize of $200.00. 2, 3, 4. Number of words written, number of solutions, style and number of illustrations—unlimited. 5. *All* papers to become the property of Cleveland Chapter, ASTE, under jurisdiction of the Standards Committee. 6. Decision of judging committee to be final.

7. Judges reserve the right to reject any or all articles. 8. Contest open to all members of Cleveland Chapter, ASTE, except members of the Standards Committee and judges. 9. Deadline for submitting papers to be midnight, January 31, 1948. 10. Application of entry and request for additional information to be forwarded to: H. H. Berg, Chairman, Cleveland Chapter, ASTE, Standards Committee, 1527 Elbur Ave., Lakewood, Ohio.

Explains Correct Usage Of Diamond Tools

Milwaukee, Wis.—"Uses and Abuses of Diamond Tools in Industry" were contrasted by Walter Meinhardt, President of the Meinhardt Diamond Tool Co., Chicago, Ill., in an address before Milwaukee Chapter members, October 9.

A sound film, "The Eternal Gem," depicting the mining of diamonds, was shown by the speaker.

Many questions were asked by the audience and ably answered by Mr. Meinhardt, at the conclusion of his talk.

After the technical program, two sports films, "Thrill a Second," and "Goose Hunting" were shown, and refreshments were served.

Chairman Paul Butzin presided at the meeting and Program Chairman Joseph Ebner presented the speaker.

Ladies Night Observed

Erie, Pa.—The fourth annual ladies night dinner and dance of Erie Chapter was held at the Moose Club, October 24.

Speaker of the evening was Francis D. Bowman, Director of Public Relations for The Carborundum Co., Niagara Falls, N. Y., who discussed Iroquois Indian lore and legends.

"Wes" Scott and his orchestra furnished music for dancing and the Almhagen Trio played during dinner. Approximately 50 members and guests attended the social event.

Los Angeles Honors Ladies with Gay Social Event

Left: Alpine musicians oblige with selection requested by a guest at Los Angeles Chapter Ladies Night, October 9. Right: Dr. Enrico Cordoza, Brazilian engineer and publisher and principal speaker at the social affair, tells Chairman Leslie Hawes about his travels in North America. Dancing followed the dinner and speaking program

Public Apathy to Child Crime Charged by Penologist

South Bend, Ind.—Dollars spent to combat juvenile delinquency today will save thousands in taxpayers' money expended on prison inmates in later years, according to Joseph E. Ragen, warden of the Stateville, Ill., prison, who addressed the October dinner meeting of South Bend Chapter in the Indiana Club.

Society in many cases is responsible for men finding their way to prison, the speaker charged. There is too much talk about child delinquency and too little real action, for everyone is too busy to help the unfortunate child during the formative years.

Warden Ragen strongly condemned radio crime programs, declaring that they poison the minds of youngsters and often give them an introduction to the criminal world.

The educational, vocational and industrial program at Stateville prison was outlined for the engineers. Each inmate of the penitentiary for long-term convicts and "repeaters" must complete the eighth grade of his education. More than 35 trades are taught, Warden Ragen said.

Although admitting that not every man in prison should be released, he asserted that those discharged should be aided in their difficult task of readjustment.

The thought uppermost in the minds of administrative officers at Stateville, the warden averred, is: "When we release a man, will he go into the outside world a better citizen or a better criminal?"

Rolling Mill Operations Viewed by Indiana Group

Richmond, Ind.—A group of 175 members, wives, and specially invited guests of Richmond Chapter visited the Middletown plant of the American Rolling Mills, October 14.

The evening tour was conducted by experienced guides who explained the working of the hot molten steel into ingot molds. The white hot ingots are passed through a series of slabbing mill rollers to become sheet steel. The sheets then go through the processes of galvanizing and protective coating.

Souvenirs were presented to the guests and refreshments were served at the conclusion of the tour.

Situations Wanted

MANUFACTURING ENGINEER, 42, desires responsible supervisory or administrative position. Experienced in forging, stamping, drawing, machining and heat treatment of metals; also design and development of tools, dies and mechanical equipment for complete manufacture and assembly of metal products for job shop or mass production. Knows tool planning, manufacture, inspection and procurement; job evaluation, merit rating, methods improvement and operation sheets. Good organizer with ability to coordinate engineering and production personnel. Now available and free to go anywhere. Please address replies to Box 134, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

MANUFACTURING EXECUTIVE with thorough management and manufacturing background in production of machine shop and metal stamping products. Unusual ability to get things done. For further information write Box 133, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

SALES ENGINEER, 44, with good experience record (including design and development) on special hydraulic production machinery, hydraulic conversions and complete hydraulic items; also qualified on lamination dies. Have excellent sales connections, sales facilities and Detroit social contacts. Graduate engineer; free to travel. Investment considered. Address Box 135, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Coming MEETINGS

ALL CHAPTERS—January. Election of Nominating Committee. Consideration of nominees for National Directors.

BUFFALO-NIAGARA FRONTIER—Christmas Party, 7:30 P.M., December 13, The Lamm Post, Williamsville, N.Y. Dinner dance, dress optional. Prizes, favors for the ladies.

CLEVELAND—January 9. Plant tour of National Acme Co. March 15-19, ASTE Tool Engineers' Industrial Exposition and 16th Annual Meeting, Cleveland Public Auditorium.

DENVER—January. Speaker: C. W. Powell, Carboloy Co., Inc. Subject: "Carbides."

DETROIT—Christmas Party, December 11, Book-Cadillac Hotel.

ELMIRA—January 5, 7:00 P.M., Mark Twain Hotel. Speaker: F. D. Bowman, Director of Public Relations, The Carborundum Co., Niagra Falls, N.Y. Subject: "History and Development of Abrasives."

ERIE—January 6. Speaker: S. M. Weckstein, Chief Engineer, The Timken Roller Bearing Co., Canton, Ohio. Subject: "Manufacture and Appplication of Roller Bearings."

FLINT—December 11. Ladies Night. January 15, Plant tour of AC Spark Plug Div., General Motors Corp.

HAMILTON—December 11, 7:00 P.M., Fischer's Hotel, Hamilton. Speaker: J. R. Keen, Gisholt Machine Co., Madison, Wis. Subject: "Turret and Automatic Lathes."

HARTFORD—January 5. Speaker: W. H. Spence, Brown & Sharpe Mfg. Co. Subject: "Tooling for Automatic Screw Machines."

HOUSTON — Annual Executives Night, January 13. Speaker: Tell Berna, Gen. Mgr., National Machine Tool Builders Asso.

MILWAUKEE—December 11. Plant visitation to Allen-Bradley Co. Dinner, meeting, sports films, cards and refreshments. January. Annual Dinner Dance.

ROCHESTER—January 5, Rochester Chamber of Commerce. Joint meeting with Superintendents and Production Managers Group of the Industrial Management Council. Speaker: Halsey F. Owen, Asso. Professor, Industrial Eng'g Dept., Purdue University, Lafayette, Ind. Subject: "What Present Engineering College Students Expect of Their Prospective Employers."

SOUTH BEND—November 11. Speaker: George H. Sanborn, Chief Field Engineer, The Fellows Gear Shaper Co., Springfield, Vt. Subject: Film lecture, "Highlights of the Art of Generating and Gear Manufacturing Equipment," describing the theory and design of involute gear principles.

ST. LOUIS—December 13. Annual Christmas Party, DeSoto Hotel. Dinner, entertainment, dancing. Santa will pre sent gifts to the ladies.

TOLEDO—December 11, 7:00 P.M., Toledo Yacht Club. Speaker from Seal-Peal, Inc., Detroit, Mich. January 14. Speaker from Owens-Corning Fiberglas Corp. Subject: "Fiberglas Industry."

Associates Honor Ames On 25th Anniversary

Waltham, Mass.—Warren Ames, President of B. C. Ames Co., who usually entertains his employees at a company-sponsored Hallowe'en party, found himself guest of honor at a dinner tendered by his staff, October 30, in commemoration of his 25th anniversary as head of the company.

Approximately 125 persons attended the surprise dinner party which also marked the birthday of Mrs. Ames.

Token of the esteem in which they hold their chief executive was a gift presented, on behalf of the employees, by a group of veteran fellow workers. Mrs. Ames received an orchid in honor of her birthday.

Mr. Ames is a Past Chairman of Boston Chapter, ASTE.

Mass Production Viewed In Slide Fastener Plant

Erie, Pa.—The fall program of Erie Chapter was inaugurated with a dinner meeting October 7 at the Lafayette Hotel in Meadville, 75 members and guests attending.

After dinner M. H. Hetzel, Chapter Chairman, outlined the plant tour of Talon, Inc., scheduled for the evening.

A bus provided by the company transported the entire group for the round trip to the plant.

In small units, escorted by guides, the engineers followed the production of slide fasteners from the handling of the raw material to the assembly and shipping of the finished product.

The plant, claimed to be the largest of its kind in the world, manufactures approximately one million fasteners daily.

After the tour a question and answer session was held at the plant clubhouse.

Michigan Group Sponsors Weekly Technical Series

Detroit, Mich.—During October, Detroit Chapter held three special technical meetings.

The first, on October 16, featured Otto W. Winter, President of Acme Pattern and Machine Co., Buffalo, N. Y. In an address, "What Is Tool Engineering," Mr. Winter delved into the past, brought out the reasons for the existence of tool engineering and, finally, what it is now.

Rudolph Esch of Vickers, Inc., spoke on "Hydraulics Applied to Machine Tools," at the October 23 meeting. His lecture was mainly concerned with the fundamentals of hydraulics, which he linked with practical applications, gradually introducing more complex usages. Mr. Esch augmented his talk with slide films and charts.

A symposium on "Cutting Tool Design" was the technical attraction for the final session, on October 30. Speakers were Chief Engineers: H. H. Gotburg, Colonial Broach Co.; C. J. Oxford, National Twist Drill Co.; A. P. Smith, Eclipse Counterbore Co.; and C. F. Weckesser, Gorham Tool Co., all of Detroit.

Mr. Gotburg lectured on broaching fundamentals, the design of broaches and of the component machines. Mr. Oxford spoke on the design of twist drills for drilling various metals and technical problems concerning drilling practices.

High speed steel tools, their application and design were discussed by Mr. Weckesser.

Unfortunately, due to illness, Mr. Smith had to retire from the meeting before presenting his lecture.

Synthetic Sapphires Find New Uses in Industry

Columbus, Ohio—Sixty members and guests of Columbus Chapter attended a dinner and technical session October 8 in the Fort Hayes Hotel to hear John F. Ireland, Sales Manager of the Elgin National Watch Co., present an exceptionally interesting program, "Sapphire, an Engineering Material."

No longer limited to bearings, the use of sapphires in industry is expanding, the speaker emphasized. A film, slides and samples were shown during the lecture.

His quarter-century as company head is recognized by Warren Ames' associates at B. C. Ames Co., as veteran employee representatives present gifts at dinner honoring their president. From left: Chester Robbins, Mr. Ames, Charles Quigg, Olin Jensen, Holger Jensen, Percy Conner, Henry Haynes and John Savoy. Seated is Mrs. Warren Ames

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

APPLIED INDUSTRIAL MATHEMATICS, by **O. B. Jones,** Founder and President of Detroit College of Applied Science, and Founder and Honorary Member of ASTE, is not just "another" but a *new* textbook on mathematics. The author has exemplified in this book his convictions that a text should not be a storehouse of knowledge but a mental gymnasium, dedicated to the development of mathematical ingenuity. And, in addition, the entire study course becomes pleasure rather than work.

While impossible to list all of the chapter headings, it is interesting to note that the reader is started right at the origin of arithmetic and steadily progresses through more difficult and complex subjects until he reaches the practical applications of trig in the field of mechanics. Along the way, the engineer becomes acquainted with horsepower, speeds, pressures, mechanics of fluids, pulley and gear ratios, tapers, graphs, spur gears and involutometry, and strengths of materials.

For the engineer who wishes to carry his review a bit further, a pamphlet supplement—"Applied Industrial Mathematics II"—is available. This covers the Rudiments of Differential Calculus and Instantaneous Value, and, will later be expanded into a standard volume.

Mr. Jones's textbook has resulted from years of experience as designing engineer and college instructor. It provides a basis for and an introduction to the higher branches of math and engineering. The methods of learning and the various problems and exercises have been used successfully, having been developed and applied by Mr. Jones in his teaching first semester math to more than five thousand engineering students since 1926.

This volume is published by *Prentice-Hall, Inc.*, 70 Fifth Ave., New York, and available at $4.00 per copy.

ILLUSTRATED JIG-TOOLING DICTIONARY, by **Torger G. Thompson** and **Ross A. Peterson,** offers beginning tool designers and toolmakers a quick reference source for the basic fundamentals of their profession. Nevertheless, the authors have drawn heavily from their experience in the aviation industry—given full rein during the war years—and many of the ideas transcribed here could well be of use to experienced engineers in other fields.

The functional drawings which represent the 1000 or more terms most commonly used are unusually well executed. The use of this book is extremely simple, making it conversely as valuable to students and to those who have only rare contact with tooling and require more frequent access to a definition source.

The title is in a sense a misnomer, since the book not only shows a thorough study of jig-tooling terminology, but also laps over into general tooling, diemaking, and production to the point of being equally valuable to others than those concerned directly with the design, building, or use of jigs.

Typical tooling procedures are illustrated and explained by series of drawings. Special terminology used in such industries as aircraft and shipbuilding is also included. Many useful reference tables are included in the appendix, as, for instance: mathematical procedures, formulae, the properties and treatment of metals, standards and basic dimensions.

ASTE member Torger G. Thompson is a skilled production illustrator and engineer with a broad background, including service as a Tool Designer with North American Aviation, Inc. Similarly Ross A Peterson, Director of the Texas Trade School, has a wide engineering experience in private industry as well as education. Their valuable book may be ordered, at $7.50 per copy, from *The Macmillan Co.*, College Dept., 60 Fifth Ave. New York.

FINISHES FOR ALUMINUM, edited by **G. W. Birdsall,** Manager, Technical Editorial Service, Reynolds Metals Co., is an authoritative, quick-reference handbook, published in two sections. Section One describes in a clear, concise manner many different types of finishes, their characteristics and application. The later volume, Section Two, supplements this information with practical shop data on materials, equipment, solution preparation, procedure and control in the form of Standard Process Bulletins.

Information in both sections is brought up to date periodically with additions and revisions in the form of new pages for quick insertion in the patent ring binder. This service is available to registered holders of Section One, the distribution of which is limited to engineers for whom the information is considered essential. Inquiries should be made to the Technical Editorial Service, *Reynolds Metals Co.*, 2500 S. Third St., Louisville 1, Ky.

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Here are a few of the many features of this reference book:

1. Comprehensive outlines for determining dimensions for standard and special thread gages. Also tabulated dimensions for several thousand plug and ring thread gages.

2. Many formulae for solving design problems, devised by the author from necessity during his many years of designing and manufacturing experience.

3. Unique Slide Rule Digit System for placing the decimal point.

4. Eight-decimal-place tables of all the natural trigonometric functions to every minute. Functions read in one direction for the full 90°. Interpolation examples are included.

5. Conversion tables for hundredths of a millimeter to inches and hundredths of an inch to millimeters.

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BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

DRIVER-HARRIS CO., Harrison, N.J., announces a 72-page *Catalog R-46*, which describes Nichrome, Chromax, and other high-nickel electrical heat and corrosion resisting alloys.

GUY S. BURTIS, One N. LaSalle St., Chicago 2, tells *How to Avoid Losses from Employee Depreciation* in a 12-page booklet, which reviews employee pension plans now in operation.

PORTER-CABLE MACHINE CO., Syracuse, N. Y., has published a collection of reprints of articles originally appearing as institutional messages in the local press. These outline the very liberal company policies on annual wages, employee recreation, union-management teamwork, pension plan, and profit-sharing.

Recent publications of the **NATIONAL AUTOMATIC TOOL CO., INC.**, Richmond, Ind., include *Natco A-65 Cam Feed Machines*, designed for high production small parts, *Natco A-33 Light Sensitive Multi Driller or Tapper*, and *Natco Borface Turning, Boring, and Facing Units*.

The **FLEX-O-SHAFT COMPANY**, Prairie View, Ill., is offering a folder describing its *Flexible Shaft Tool Kit*, featuring a small-diameter, aluminum handpiece for $\frac{1}{8}$" and 3/32" shank-mounted wheels, a hang-up 1/16 HP motor, and 66 popular tool accessories.

Fingertip Variable Speed Control, 4-page bulletin by **FAST FEED MACHINE CORP'N**, 218 Kunkle Bldg., Ashtabula, Ohio, describes the new 9, 10, and 30-ton Open-Back Inclinable Punch Presses.

Nickeloid Metals Fabrication Handbook, **AMERICAN NICKELOID CO.**, Peru, Ill., has 16 pages of general information, practical fabricating suggestions, application examples, and instructions relative to the proper handling of pre-finished Nickeloid Metals.

THE TORRINGTON COMPANY, Bantam Bearings Div'n, So. Bend 21, Ind., are offering Bulletin 200 on the recently developed line of *Torrington Self-aligning Spherical Roller Bearings*.

NATIONAL SUPPLY CO., Box 899A, Toledo 1, Ohio, describes its *Ideal Power Slush Pump*, Type C-350, in Bulletin 320, with emphasis on the extreme ruggedness and durability required of modern drilling machinery. Also available is *Combination Line Anchoring and Drilling Control*, a new method of weight-measurement achieved with National's Ideal Type D Wire Line Anchor and the Martin-Decker Corp'n Type D Weight Indicator.

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The Apparatus Dep't, **GENERAL ELECTRIC CO.**, Schenectady 5, N. Y., offers *Specialized Testing and Measuring Equipment Catalog*, giving information on more than 90 items, too numerous to fully classify here. Included are time, speed, and torque measuring instruments; chemical analysis, resistance and insulation testing equipment; vacuum and pressure measuring and electric circuit testing devices.

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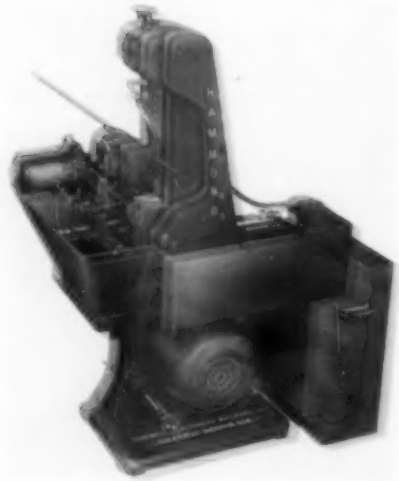
TOOLS OF TODAY

Centerless Grinder-Polisher

First shown at the '44 National Metal Congress, Cleveland, and since improved and now in production, a **CYLINDRICAL GRINDER-POLISHER** Model OD-1—by the *Hammond Machinery Builders, Inc.*, Kalamazoo, Mich., will grind and polish rods, bars and tubes from ⅛" to 1¾" in diameter.



This centerless machine uses coated abrasive belts for grinding and polishing. Stock removal rate is up to .005" per pass on ferrous metals, and up to .010" on non-ferrous. Work supports will handle ½" bars up to 18' long and 1" bars up to 8' long. Claimed accuracy is .001" on production items, closer limits on some work. T-12-1

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4 Way Air Valve by Knox

Termed the "Air-Miser", a new 4-way **AIR VALVE**, by *Knox Industries, Inc.*, Lexington, Mich., incorporates a by-pass port which allows half of the compressed air used in the power stroke of a cylinder to be used for the return stroke. This feature, together with an auxiliary port and a neutral position, is said to reduce air volume ordinarily required by 50%. T-12-3

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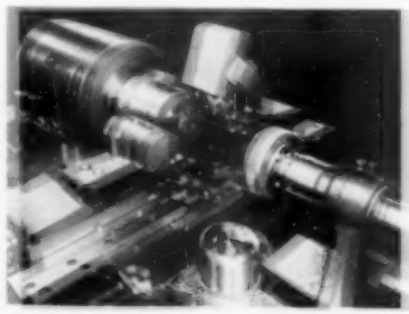
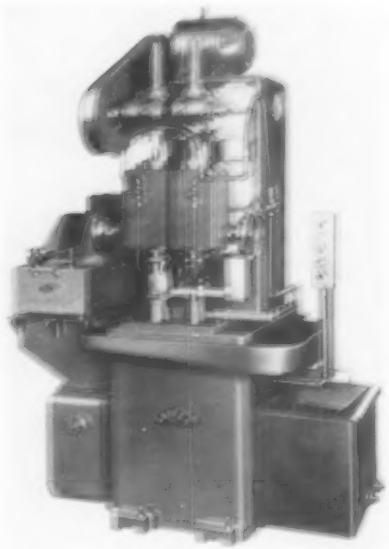


Upon completion of their work, the cutters automatically retreat, allowing the beading or curling attachments their turn at the part. After the completion of their operation, the curling and beading attachments return to their original position, giving free access to the operator for shell removal and the next installation. T-12-4

Automatic Con Rod Balancer

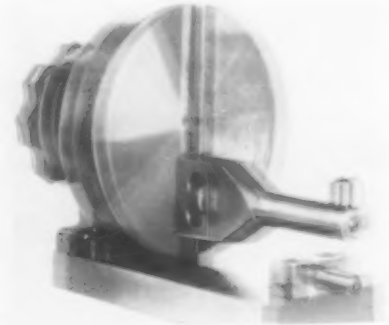
Greater efficiency and lower unit cost are claimed for a special **BALANCE-MILLING MACHINE**, for automotive connecting rods, by *Snyder Tool & Engineering Co.*, 3400 E. Lafayette, Detroit 7. With the exception of setting the quills for depth, operation is completely automatic.



Parts are weighed on integral scales, depth of cut set according to pre-determined weight-depth ratio and milled in an automatic cycle with inserted-blade high speed steel cutters. The rod is then turned over in the fixture and the cycle repeated. T-12-5

Radius Wheel Dresser

A low-priced **RADIUS EMERY WHEEL DRESSER**, by *Montgomery & Company*, 53 Park Place, New York 7, dresses all concave radii up to and including 2½", and all convex radii to 1⅜" inclusive. The dresser slides in a T-Slot and is rotated by a hand knob. T-12-6



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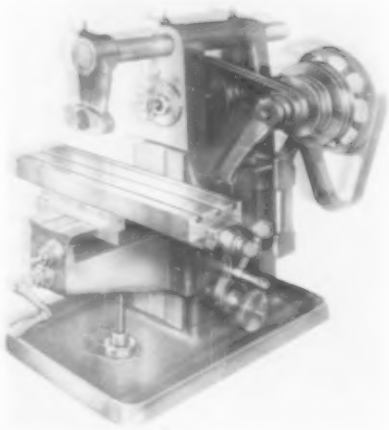
Bench Milling Machine

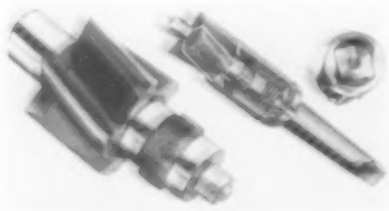
A recent addition to the Diamond line of milling machines, by *Diamond Machine Tool Co.*, 3429 E. Olympic Blvd., Los Angeles 23, Cal., is the Model B-12 **BENCH MILL**. Weighing 450 pounds, this is the largest bench mill manufactured by the company. The machine has a 4½" x 20" table, with longitudinal travel of 12", vertical travel of 9", and transverse travel of 6". Three table T-slots are provided. The spindle, with nose is hardened and ground, is mounted in tapered roller bearings and is equipped with No. 9 B & S taper. A needle-type bearing, mounted in overarm bracket, provides friction-free, trouble-proof support for arbor.



An unusually powerful drive, for heavy cuts without belt slippage, is provided by a three-step pulley with double "B" V-belts. The design permits rapid belt shifting and tension adjustment. Speed range of the spindle varies from approximately 100 to 1400 RPM. Full specifications and technical information on the Diamond B-12 Milling Machine are available in a circular.

T-12-7

"Twist of the Wrist"



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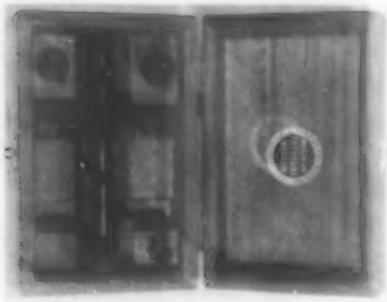
T-12-8

Fuel Test Equipment

Previously manufactured for use by injection equipment manufacturers, but now expanded to meet a more general demand by industry as a whole, a line of **TEST APPARATUS** by *Ferrier Engineering*, 185 Breckwood Blvd., Springfield, Mass., includes standardized Fuel Injection Test Equipment such as Pressure Indicators (mechanical and optical), Pump Calibrating and Governor Regulating Test Stands, Spray Test Apparatus, Accessory Equipment and Service Tools.



Shown is a Maximum Pressure Indicator, especially useful in research work but equally applicable for all laboratories, industrial plants, service stations, and on shipboard where fuel injection equipment is used. Available in either of two models—Type FI-101 and Type FI-102—the Indicator is used to determine the maximum pressure developed when any component of the fuel injection system is altered or when conditions are changed.

T-12-9

Hydraulic Pump Units

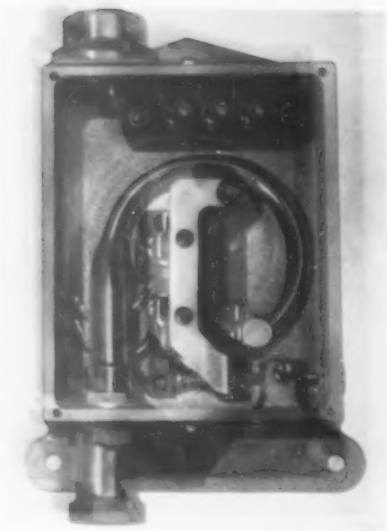
New, improved **HYDRAULIC PUMP UNITS**, announced by the *Gerotor May Corporation*, Maryland Ave. & Oliver St., Baltimore 3, Md., embody various sizes of Gerotor hydraulic pumps and are designed to deliver a steady oil flow at continuous working pressures up to 1000 psi. Each pump unit comes complete with dust-proof, easy-to-clean tank; combination filler, screen and breather cap; graduated oil level indicator; pressure gauge and gauge shut-off valve; adjustable relief valve; flexible coupling; and all necessary piping. Units are furnished standard for N.E.M.A. frame motors, but special motors can be mounted if required.

Hydraulic pump units are available with single pumps or with double pumps for two separate circuits.

A new catalog section, containing drawings, dimension charts and selection tables, is available on request.

T-12-10

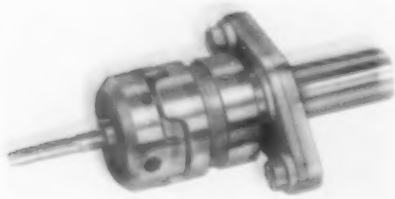
Pressure Operated Switch



Shown with cover removed is **PRESSURE OPERATED SWITCH**—Model 310, by the *Meletron Corporation*, 950 No. Highland Ave., Los Angeles 38, Cal.—which has promise of wide application throughout industry. Actuated by the pressure of liquids, it can be widely used as a control mechanism for chemical, food, and petroleum processing, as well as for pneumatic and hydraulic systems, machine tools, and automatic cycle machinery. The Model 310 is one of many, manufactured by Meletron, which are actuated by pressure of liquids, air or gases.

T-12-11

Releasing Tap Holders



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T-12-12

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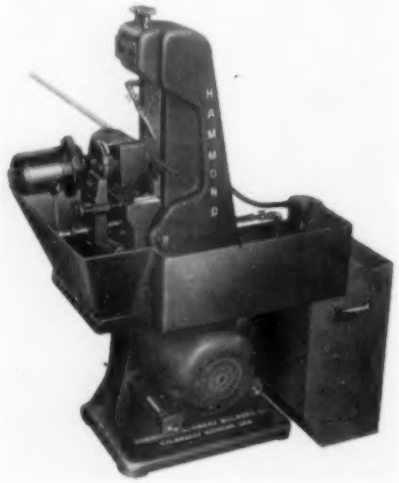

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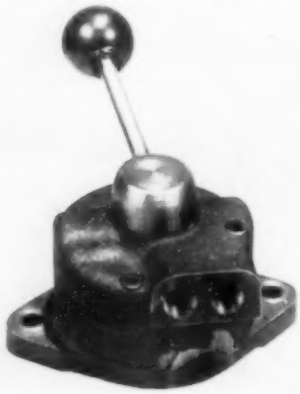

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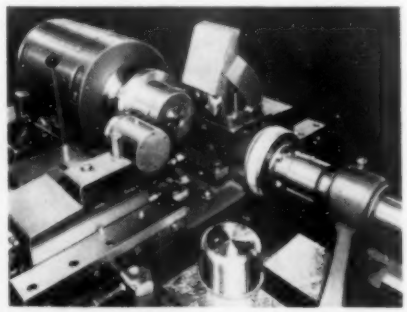

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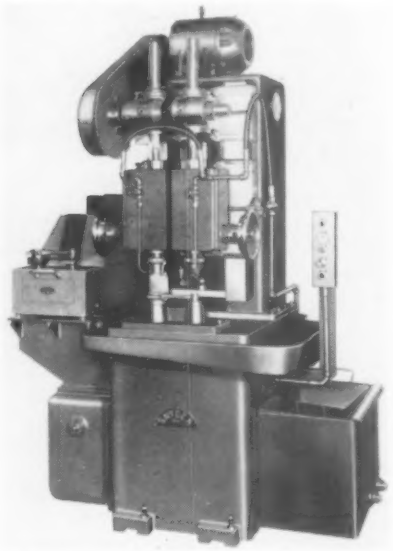

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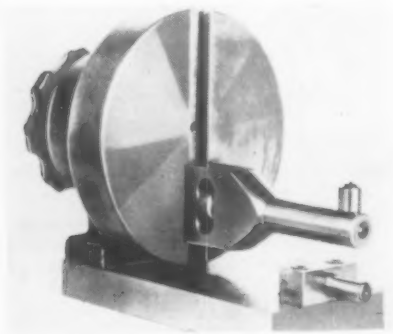

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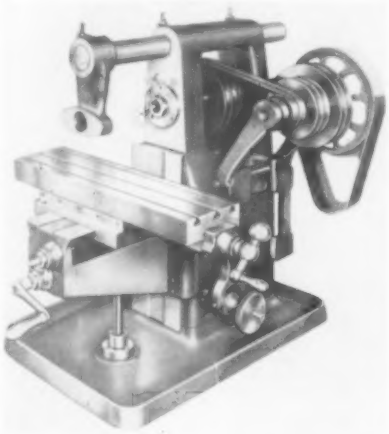

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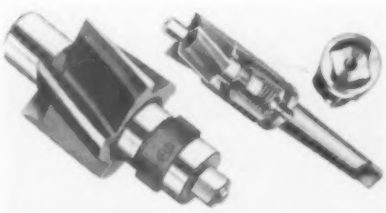

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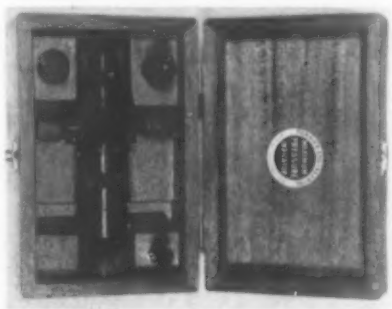

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T-12-10

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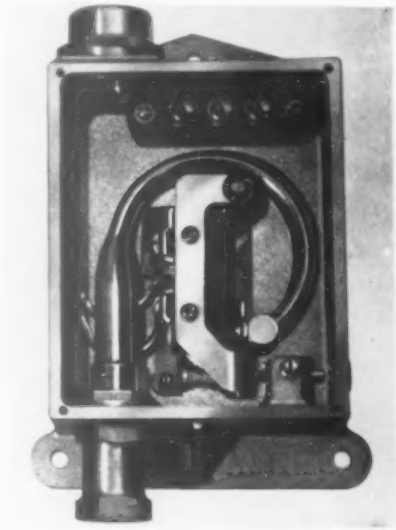

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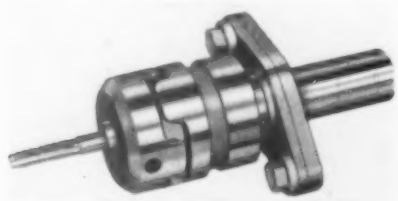

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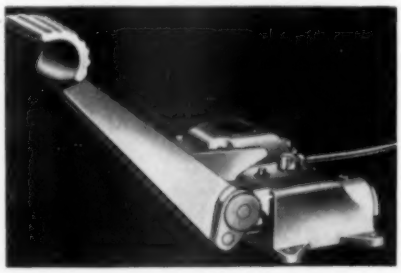
Hydraulic Foot Pump

A small and compact lightweight **HYDRAULIC FOOT PUMP,** said to offer exclusive features in size, operation and design, and recently introduced by the *Lyon-Raymond Corporation,* 3893 Ma-



dison St., Greene, N. Y., is designed so that the pedal return spring is built inside the body. Release is controlled by slightly raising the single pump pedal.

The unit, including oil reservoir, built-in oil strainer and relief valve, is self contained and may be mounted in offset position, if desired. It is designed for working pressures up to 1500 psi.

T-12-13

New Hi-Temp Kennametal

A new, very hard metal that retains its strength and resistance to corrosive high temperatures, and known as **GRADE K138,** is a recent development by *Kennametal Inc.,* Latrobe, Pa. A special "cemented carbide" composition similar to the carbides currently used for cutting tools, but with unique properties, the new metal is said to withstand temperatures that rapidly destroy conventional carbides and the best cast alloys.

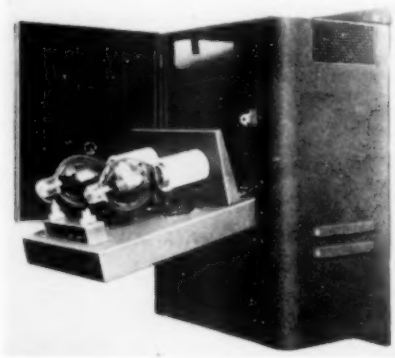
In tests, the metal has been heated to 2100°F, for 48 hours, without loss of strength and, when heated to 1800°F and quenched in water, showed no appreciable change. Its unique properties suggest many practical uses; especially, it may find wide use for trimming hot welding flash. **T-12-14**

New Speed Chuck

A new **SPEED CHUCK**—the Model 3E1 Fry Multi-Duty Speed Chuck—announced by *Airo Products Company,* 2938 Denby Ave., Los Angeles 26, Cal., combines the advantages of both collet and jaw chucks. The jaws, of hardened tool steel with positive position lock, are quickly adjustable to concentric or eccentric work, with repeat performance guaranteed by the maker. The chuck may be opened or closed while in high speed motion, either direction, and holds round, square or hexagon stock. **T-12-15**

Electronic Rectifier

A new **ELECTRONIC RECTIFIER,** especially useful for small DC motors, magnetic chucks or other applications where direct current is required, is announced by the *Weltronic Company* (Dept. K), 19514 W. Eight Mile Rd., Detroit 19.



Known as the Series WR 40-50-60, and designed to replace motor generator sets where power from 750 to 2000 watts is desired, the unit features better ventilation, easier accessibility to parts and simplified construction. The panel, which tilts forward for servicing, contains the power tube, terminal strip, main line switch, fuses and time-delay relay. A red light shows when the unit is energized. **T-12-16**

Corrosion Inhibitor

A Corrosion Inhibitor—**STEELYFE 11**—for steel and other metals, developed by the *Bee Chemical Company,* Chicago 1, has as its active ingredient the barium salt of an alicyclic sulfonic acid. Not only is it claimed to act as an outstanding and effective corrosion preventative, but there is the added protection against corrosive sulfate ions which react with the barium to liberate alicyclic sulfonic acid which, in itself, is an effective corrosion preventative.

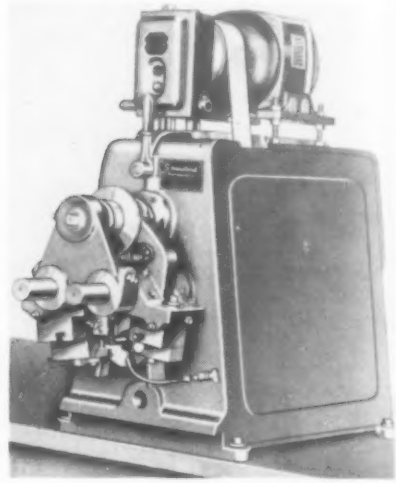
Steelyfe 11 is a thin, dark liquid having a flash point of about 150°F, can be applied by dipping, brushing or spraying and which, upon evaporation, leaves a soft, transparent coating that, at any time, may be removed by wiping or degreasing. **T-12-17**

Electric Erasing Tool

A hollow shaft **ELECTRIC ERASING TOOL,** by *Charles Bruning Company,* 4754 Montrose Ave., Chicago 41, is designed for clean, smooth erasures on tracings, drawings and copy, in a matter of seconds, 7" long erasers, which may be inserted through either end of the hollow shaft, and chuck gripped, eliminate waste and the nuisance of frequent changing. The tool is shaped for easy hand grip. **T-12-18**

"Standard" Screw Machine

An **AUTOMATIC SCREW MACHINE,** originally developed by *Standard Machinery Company,* Providence, R. I., for production of bullet jackets, has been made into a high production tool that will accommodate all normal screw machine operations with the exception of thread cutting on stock up to 1" diameter.



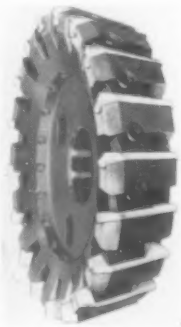
This machine features compact size, set up on 24" spindle centers; high production rate, quick chucking and cam shaft speed up; operating efficiency; and all tool settings, adjustments and controls accessible at front of machine.

What is said to be an outstanding improvement renders impossible the formation and clogging of long chips, a feature of particular importance in working plastics. Twice in each revolution of the spindle, the rotation of the feed cam shaft is interrupted, breaking each chip as it is formed. Motion of the cam shaft does not stop entirely, but rather vibrates harmonically within an amplitude sufficient to break each chip. The tool dwells at the end of its movement while the work is made accurately cylindrical. **T-12-19**

"Axial Face" Kennamill

Kennametal Inc., Latrobe, Pa., has introduced a new mill—termed **"AXIAL FACE"**—in sizes 6", 8", 10", 12" and 14". Designed especially for production milling of cast iron, the new mill is said to incorporate the advantages of solid blade face mills with maximum number of blades.

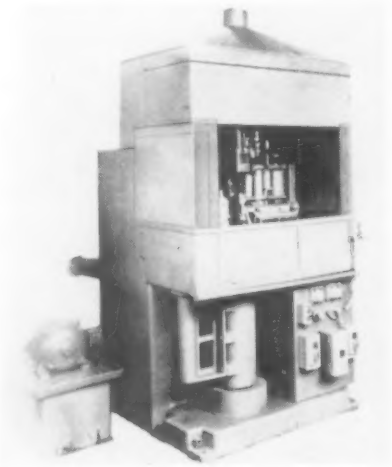
Among other advantages claimed are assembly to within a few thousandths on face and periphery, simplified grinding and longer life, between grinds, due to rigid blade mounting. The cutter can be mounted on all common spindles with bolt circle provided to order.



T-12-20

New Production Grinder

A new type Vertical Spindle Full Hydraulic **GRINDER**, by *Charles H. Besley and Company*, 118 N. Clinton St., Chicago 6, is designed for production grinding faces of hedge shears, wood chisels, plane bodies and cutlery.

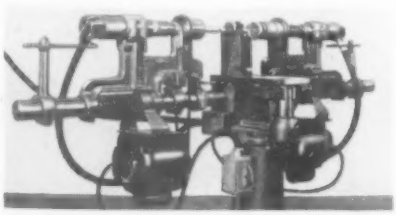


The machine features a feed fixture, into which the operator places the rough part or forging, which then swings down into the horizontal position, advances to the grinding wheel, makes the required number of passes and, at the same time, feeds down mechanically. Upon reaching a micrometer stop screw, work automatically recedes from the grinding wheel and returns to unloading-loading position.

For greatest efficiency, two machines are used. With the operator between the two, he takes a semi-finished part from one machine and then grinds the opposite side on the companion unit. With two units, production is at the rate of 600 sides per hour, for hedge shears, or 300 complete shears. By changing fixtures, the machine will also grind the bevel cutting edges. **T-12-21**

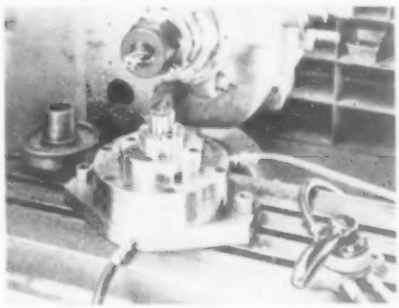
Double End Airflex Riveters

While originally tooled to rivet simultaneously both ends of a door hanger axle, a **DOUBLE-END RIVETER**, by *Lemert Engineering Company*, 1200 N. Western Ave., Plymouth, Ind., can be applied to a wide range of other riveting operations.



Incorporating the principle of the Lemert "rotating impact," the machine combines precision controlled straight line pneumatic hammer blows with a fluted, rotary peen that makes possible riveting of such brittle materials as glass, plastics, fibre, wood and hollow ware. **T-12-22**

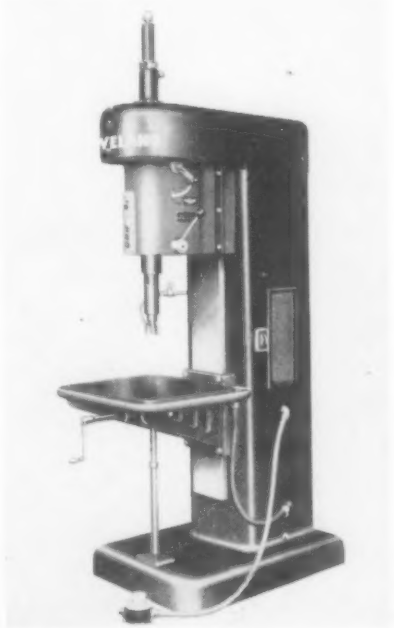
Air Operated Milling Fixture



A special air operated **WORK-HOLDING FIXTURE**, by *Erickson Tools Div'n*, 2309 Hamilton Ave., Cleveland 14, Ohio, incorporates an Erickson Precision face plate mandrel. The fixture, designed for mounting on milling machines, is fitted with special locators for positioning workpieces so as to hold them perfectly square and concentric to the spindle as well as in exact relation to reference points. Additional sizes increase range of work to be handled. **T-12-23**

New Tapping Machine

New higher speeds and economy in precision tapping are claimed for the streamlined **MODEL E TAPPING MACHINE**, recently announced by the *Cleveland Tapping Machine Company*, Hartville, Ohio. In addition to single hole tapping at high speeds, the machine is designed for efficient use with multiple heads for group tapping in one pass.

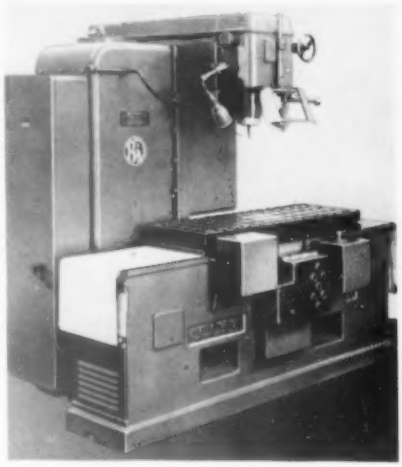


Adjustable heads may be used where the pattern of the holes varies in production, and indexing tables, cross slides and hopper feeds may be combined with automatic cycling to provide completely automatic operation. Tapping depth is precisely controlled, within .005", by means of a dial, and fidelity of thread form is assured by an accurate lead screw. **T-12-24**

New P & W Die Sinker

Introduced at the recent Machine Tool Show, a new **DIE SINKER**, by *Pratt & Whitney Division*, West Hartford, Ct., incorporates the new P & W "Direction," a single lever device which, by novel electrical means, controls automatic continuous compound movements in any direction, horizontal or vertical.

Corresponding in the general capacity specifications of a predecessor—the No. 4—designed several years ago, the new No. 4D Die Sinker is radically different in appearance and principle, and presents an entirely new approach toward sinking impressions in modern, tough die steels.



The three fundamental machine motions necessary for die sinking are provided through a longitudinally moving work table of fixed height and a vertical slide carrying a transverse (cutter spindle) slide. Movement of these slides (always under power) are governed by the new P & W Directron," a single-lever device which, by novel electrical means, controls automatic, continuous compound movements in any direction, either horizontal or vertical.

Thus, difficult hand feeding is eliminated, and layout lines on simple or intricate die surfaces are followed exactly under effortless pilot hand control. Templates, representing various longitudinal or transverse cross sections, can be mounted on the machine and traced in their respective planes by an electric follower which accurately and automatically controls the corresponding machine motions. **T-12-25**

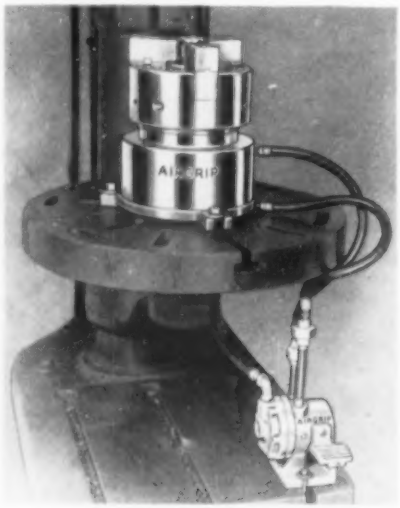
New Cutting Oil Additives

Two new **CUTTING OIL ADDITIVES**—Cresol Z-2 and Cresol Z-2A—by *Lubricants, Inc.*, Fisher Bldg., Detroit, are designed to assist in the production of cutting oil coolants, drawing compounds, metal forming and extreme pressure lubricants.

Modified sulphur-chlorides containing as high as 40% sulphur and 30% chlorine, they are said to produce cutting oils of unusual metal cutting quality, at low cost, when added to light mineral oils in percentages of one to four percent. **T-12-26**

Drill Press Air Chuck

A new type "Airgrip" **DRILL PRESS CHUCK** and Cylinder combination, with "Airgrip" Foot Control Air Valve, introduced by the *Anker-Holth Manufacturing Company*, 2733 Conner Street, Dept. 75, Port Huron, Michigan, is designed to increase production where extensive drilling, tapping or counterboring operations are performed.



Chuck and cylinder combinations can be furnished with either solid or hollow centers. The open center permits the workpiece, when released, to drop through the unit, thereby saving handling time. The valve automatically locks into position when operator applies the initial pressure, and unlocks on a second application. **T-12-27**

New Jackhammer

A new **ROCK DRILL**, designated as the **J-10 Utility Jackhammer**, and applicable to a wide range of industrial uses, is announced by the *Ingersoll-Rand Company*, Phillipsburg, N. J. Light in weight and easy to handle, it is ideally suited for overhead work (as shown). By using adaptors, star drills can be used to drill holes 1⅛" and under; also, it can be applied to chiseling, channeling and riveting operations. **T-12-28**

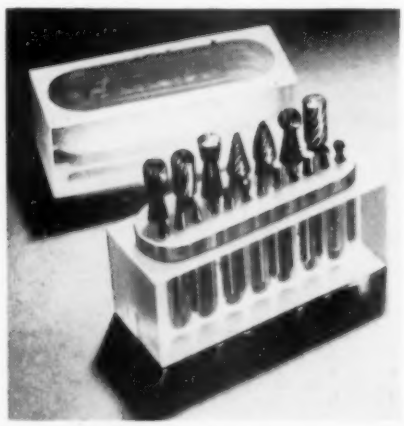
New Gages by Van Keuren

A new set of **MICROGAGES**, by the *Van Keuren Company*, 176 Waltham St., Watertown, Mass., includes 1", 2", 3", 4", 5" and 6" microgages, ⅞" in diameter, designed for precision setting of large micrometers.

Up to 1", the microgages are held to a tolerance of plus 12, minus 8 millionths of an inch; up to 6", within a total tolerance of 15 millionths per inch of gage length. The set will make combinations up to 21 inches and is furnished in a solid mahogany case. **T-12-29**

Solid Carbide "Carburs"

Lincoln Park Industries, Inc., 1719 Ferris Ave., Lincoln Park 25, Michigan, announces the addition of two new standard sets of **CARBURS**, making a total of three by this company. Each set, one of which comprises seven different tools of ¼" head diameter and with shanks ¼" in diameter and 1¾" long, is contained in a handy plastic case. The other combines the seven ¼" diameter tools with the standard set of eleven Midget Carburs which have ⅛" head diameters and are 1⅛" overall with ⅛" diameter shanks. The Midget Carbur set also continues to be available.



These tools, which are claimed to cut practically any material including hardened steel, and to have cutting life 50 to 100 times over that of steel, are used to replace steel rotary files and small grinding wheels. Made of solid cemented carbide (shanks are not brazed to the heads) the tools may be run at very high speed. **T-12-30**

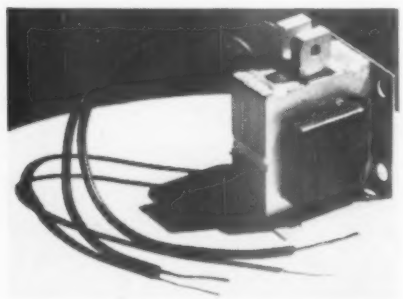
Hydraulic Power Feed

A new **HYDRAULIC POWER FEED** for their sliding head model drill presses, by the *Canedy-Otto Mfg. Co.*, Chicago Heights, Ill., combines high efficiency with simplicity of design. Of interest is that, while the new development will be incorporated into new C-O drill presses, it will also be available for easy attachment to existing models.

The hydraulic power feed, which makes the machines fully automatic instead of semi-automatic as heretofore, can be operated automatically, semi-automatically, or manually, as desired. Reciprocating action permits boring and tapping in addition to drilling and tapping. **T-12-31**

Small All-Welded Solenoid

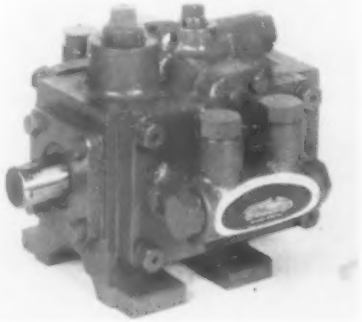
Operating on 110 volts, 60 cycles, a new small **ALL-WELDED SOLENOID**, for use where powerful pull is needed in a small space, and introduced by the Control Division of the *General Electric Company*, develops a maximum pull of .26 lb. in a ½" stroke.



Frame and plunger laminations, each welded together for greater efficiency, are of silicon steel, providing more pull per watt input. Frame and bracket—the latter L shaped for vertical or horizontal mounting—are also welded together, with the removable coil sealed inside a moisture proof plastic housing. A new type pole shader insures maximum quietness. **7-12-32**

Four-Piston Hydraulic Pump

A new, 4-piston **HYDRAULIC PUMP**, weighing but 30 pounds and designed to operate in either direction without further modification, is announced by *Miller Hydraulic Engineering and Sales*, 3015 Hart, Detroit 14.



The four pistons are horizontally opposed, with hardened steel throws keyed to the drive shaft, and sturdy, one-piece forged bronze connecting rods have ball ends which take the pumping load on the inside of the piston dome.

Relief valves, incorporated in the pump, are set at the factory to the desired pressure. Discharge pressure, in psi, ranges from 0 to 3000, at 1200 rpm, with GPM delivery 5.4 to 3.0. HP input is nominal, and discharge pressure is practically independent of drive speed. **T-12-33**

Flexible Gage Handles

Lightweight, flexible collet type **ALL-METAL HANDLES** for small diameter thread gages, announced by *Lincoln Park Industries*, 1719 Ferris Ave., Lincoln Park, 25, Mich., provide flexibility which reduces pressure on the gage member and minimizes breakage due to accident or rough handling. Originally developed for carbide wire type plug gages, the flexible handles can be supplied in place of solid handles on Lincoln Park thread gages up to No. 10 machine screw size. **T-12-34**

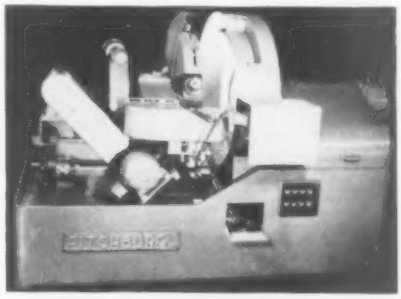
New Buffing Compound

A new series of **BUFFING COMPOUNDS**—Hydro-Buff "500," by the *Hydro-Chemical Company*, 24 Clark St., East Hartford, Ct., is said to offer unusual possibilities for reduced buffing time on both ferrous and non-ferrous metals.

Non-inflammable and soluble in all proportions in the chlorinated hydrocarbons, the compound is well suited to plants equipped for vapor-phase degreasing. It is also readily removed in water-phase cleaning. Samples, and further information, may be had from the manufacturer. **T-12-35**

New Valve Seat Grinder

An automatic **VALVE SEAT GRINDER**, by *Fitchburg Grinding Machine Corporation*, Falula Rd., Fitchburg, Mass., is said to grind the seats of automotive engine valves at the rate of 2160 per hour.

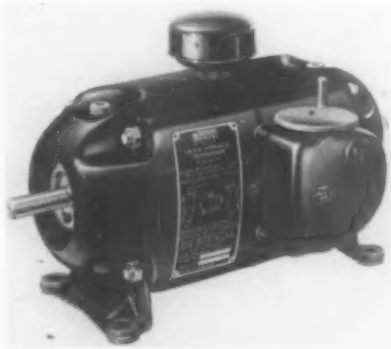


Incorporating a new method of grinding—called "Consta-Contact Grinding", in which three or more parts are in constant contact with a single grinding wheel—the machine comprises a vertical, belt driven grinding wheel, and a vertical turret having twelve spindles to receive the valve stems. Both loading and unloading are automatic.

A unique feature is that, if desired, the grinding wheel can have both coarse and fine cutting surfaces, thereby taking care of both rough and finish grinding in one pass. Also, the grinding wheel can be formed to grind several diameters and shoulders on parts within range of the present design—i.e., 3" dia. x 7" long. **T-12-36**

Variable Speed Transmission

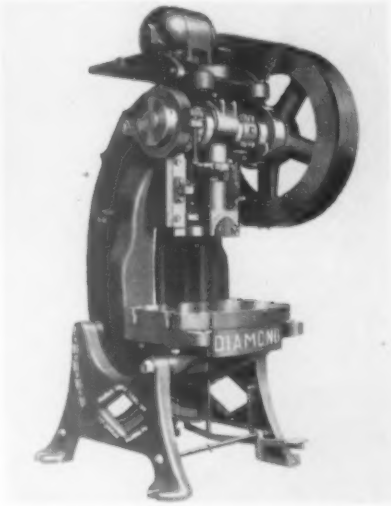
A new, Variable Speed **HYDRAULIC TRANSMISSION**, introduced by *Vickers Incorporated*, 1416 Oakman Blvd., Detroit, at the recent Machine Tool Show, features smooth and stepless speed adjustment from zero to maximum output rpm.



Designed for fractional HP machinery drives and rated at ½ HP, continuous duty, the unit maintains full and constant torque power throughout the entire speed range. The input shaft may be driven in either direction without mechanical change; also, because it is equipped with automatic overload protection, the unit may be stalled without damage. Servo or handwheel control permits fingertip adjustment over the entire speed range. Described in Bulletin 47-40. **T-12-37**

Plain Type Punch Presses

Designed to strain gage analysis, a new, plain type **PUNCH PRESS** by *Diamond Machine Tool Company*, Los Angeles, Cal., is available in 55 and 56-ton capacities. The press is of open-back, inclinable construction, with all bearings and sliding surfaces micro-finished for long life and smooth, accurate operation.

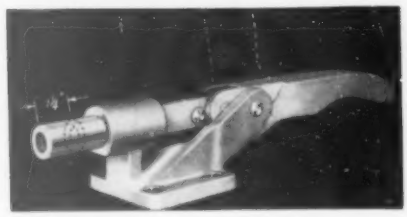


The clutch employs three sets of oversize dogs, fully supported within the clutch housing, thus materially reducing bending stresses and placing the dogs almost entirely in shear. Thus, fatigue failures at this point are practically eliminated.

Superficial specifications of the 56-ton model are: Maximum strokes per minute, 100; standard stroke, 3", with maximum (to order) 8"; shut die height, 16"; bed area 20" x 30"; bed opening, $12\frac{5}{8}$" x $16\frac{1}{2}$"; and crankshaft diameter 4" at bearings, 5" at crank. **7-12-38**

Heavy Duty Plunger Clamp

A new, extra heavy duty plunger clamp is announced by *Detroit Stamping Company*, Dept. K, 328 Midland Ave., Detroit 3. Called **THE RAM** because of its great power and fast action, and designated as Model 640, the tool is capable of exerting over 2500 lbs. normal pressure.

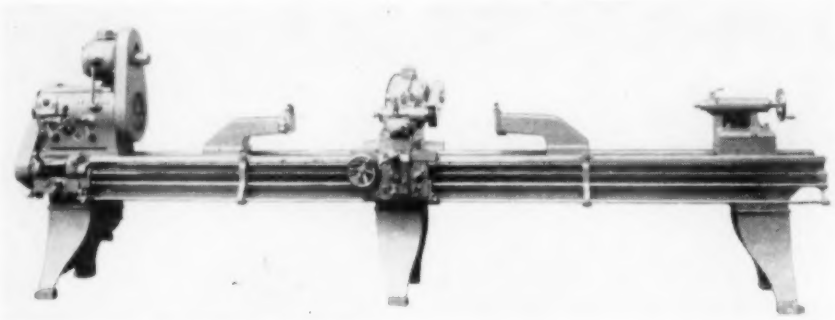


An unusual feature in toggle clamps, the handle is down when closed, of particular advantage on machines or fixtures where space is restricted, since the motion to clamp is downward and away from the work. This new addition to the De-Sta-Co line provides a fast acting holding device for machining operations and may be readily applied to various conversions. **T-12-39**

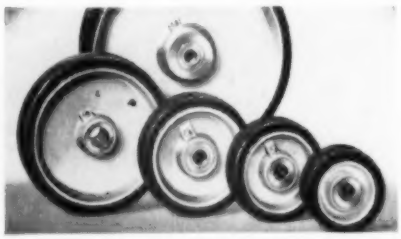
New Two-Purpose Lathe

Developed and perfected in cooperation with a leading manufacturer of printing rollers, a new **2-PURPOSE LATHE**, by the *R. K. LeBlond Machine Tool Company*, Cincinnati 8, Ohio, is designated for polishing rubber printing rollers, but is also suited to the general run of engine lathe metal turning.

Known as the Regal Rubber Roller Polishing Machine, the tool may be profitably used wherever a volume of rubber rollers must be regularly serviced in order to maintain a highly polished surface and uniform diameter throughout the length of the roller. The machines are available in six swing sizes—13″ to 24″—with bed length starting at 6 feet. **T-12-40**



New Industrial Wheels



Designers of materials handling equipment will be interested in a new line of aluminum alloy **INDUSTRIAL WHEELS**, announced by Airlite Div'n of *Aerol Company*, Los Angeles 21, Cal. Named Airlite, the new wheels are available with either molded on Grade A rubber treads or all-aluminum treads, and in sizes 4, 5, 6, 8, 10 and 12″ sizes. They may be had with ball, roller or bronze bushings, as desired. **T-12-41**

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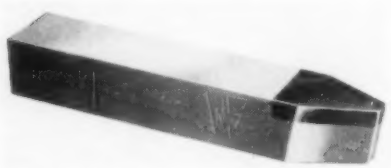
ALGONAC, MICH.

(Algonac is near Detroit)

V-Pulley Grooving Tool

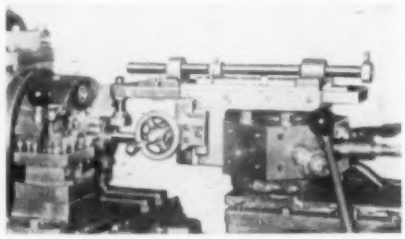
A new carbide tipped tool for production grooving of A, B, and C belt size pulleys has been developed by the *Wendt-Sonis Company*, Hannibal, Missouri. Nose widths and angles are held to close tolerances for accurate production of the finished pulley.



Standard Wendt-Sonis **grooving tools**, furnished with proper grade of carbide inserts for the material to be machined, are manufactured in shank sizes ranging from $\frac{5}{8}$″ x 1″ to 1″ square. Shanks are scientifically hardened and treated, to prevent rusting, and the carbide tips are covered with plastic to prevent chipping from handling. **T-12-42**

Taper Boring Attachment

An improvement of the **REEVE TURRET ATTACHMENT**, that practically constitutes a new model, is now offered by the *Artesan Tool & Cutter Co.*, 531 Vester St., Ferndale 20, Michigan.



Claimed to be the only turret attachment that bores straight, tapered, or contoured holes in a single cut, the device is easily mounted on the turret of any hand screw machine or turret lathe without interfering with other tool setups. **T-12-43**

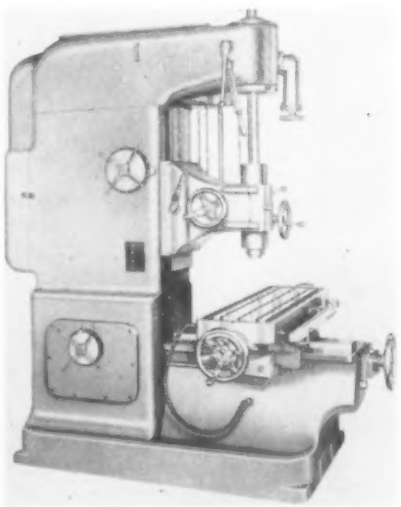
New Pump by Ruthman

A new **GUSHER COOLANT PUMP**, by the *Ruthman Machinery Company*, Cincinnati 2, Ohio, is equipped with a new style upper end bell having a large built-in conduit box with ample capacity to accommodate the multiple lead wires of dual voltage stators. The motor is fully enclosed and incorporates large, precision sealed pre-lubricated ball bearings, thus eliminating the need for oilers or grease fittings.

Through bolts fasten from inside the upper end bell for streamlined appearance and drip-proof construction. Twin inlets, within the pump, are arranged to provide dynamic balance and to eliminate end thrust on the shaft. As there is no metal to metal contact within the submerged portion, the pump can handle reasonable amounts of grit and abrasives. Capacity, at 26′ head, is 40 GPM with $\frac{1}{2}$ HP motor, and 60 GPM with $\frac{3}{4}$ HP motor. **T-12-44**

Precision Dual Machine

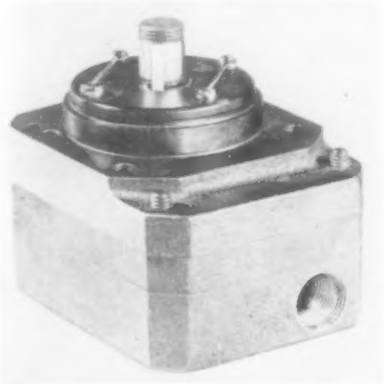
A new machine, incorporating several new features and combining the functions of a vertical miller and a precision boring machine, is announced by the *W. B. Knight Machinery Company*, St. Louis, Mo.



Designated the **KNIGHT No. 50**, the new machine is said to offer exceptional speeds and power for rapid metal removal and, while designed for simple operation, is adaptable to an extremely wide range of work. For jobbing shops, and other plants doing a wide variety of work, the No. 50 will offer the advantages of an accurate solid-base boring machine and a rigid, vertical miller without the investment required for two machines. **T-12-45**

New Hydraulic Gear Pumps

Two new **HYDRAULIC GEAR PUMPS**—Models 9000 and 9075—by the *Oil Equipment Corporation*, Bryan, Ohio, are designed for continuous service at pressures up to 1000 psi and for intermittent service up to 1500 psi. Model 9000 has a displacement capacity of 8 GPM at 1800 rpm, Model 9075 has 15 GPM at 1200 rpm, and with either model the pumped fluid may be any oil with lubricating qualities.



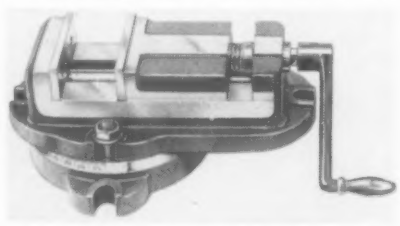
Simple in design, and incorporating wear resisting materials—such as Nitralloy gears—and a minimum of moving parts, the pumps are suited to a wide range of uses and are especially applicable to materials handling, earth moving and metal working equipment. **T-12-46**

New Flux for Aluminum

A new **FLUX**, said to have particular value for joining aluminum with dissimilar ferrous and non-ferrous metals, at very low working temperature, is announced by the *All-State Welding Alloys Co., Inc.*, 96 Post Rd., White Plains, N. Y.

Known as All-State No. 39, the new flux is claimed to produce a considerably stronger joint than one made without it. And when used in combination with All-State No. 39 Aluminum Solder, its high capillary action makes the solder flow rapidly throughout the fluxed portion of the work. **T-12-47**

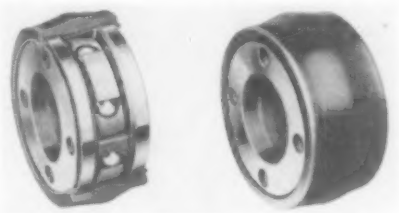
New Small Swivel Base Vise



A new, low-cost 3" Swivel Base **VISE**, suitable for milling machines, shapers, grinders and drill presses and announced by the *L-W Chuck Company*, 45 St. Clair St., Toledo, Ohio, has a graduated base and can be used plain or swivel. A large Acme screw provides rigid and durable closing. Jaws are 3" wide x 1" deep, and entire weight, with the crank, is only 16 lbs. **T-12-48**

Ballflex Couplings by Gear Grind

A **FLEXIBLE COUPLING**, by the *Gear Grinding Machine Company*, 3901 Christopher Ave., Detroit, employs hardened steel balls to effect angular misalignment up to 3 degrees, and parallel misalignment from $\frac{1}{8}$", at 500 rpm, to 1/32" at 5000 rpm.



Called the "Ballflex," the coupling is currently made in two sizes—the MC 3700, transmitting 3 HP at 100 rpm, and a smaller model which is rated at $\frac{3}{4}$ HP. A Neoprene covering, which is impervious to oil, retains lubricant and provides for quiet operation in addition to contributing to flexibility. **T-12-49**

Hi-Temp Thread Compound

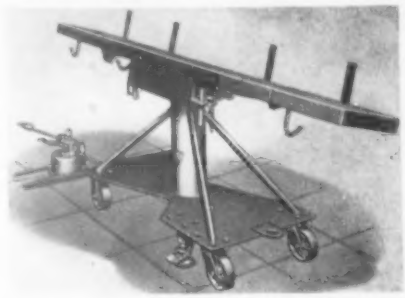
A new **THREAD COMPOUND**, developed by the *Felt Products Company* (Dept. P. 224), 1504 Carroll Ave., Chicago 7, and named the Fel-Pro "Hi-Temp," is said to prevent "freezing" and galling of metal surfaces at temperatures as high as 1800° F.

Thus, it is not only suited as a compound for pipe joints, which may be unscrewed with ordinary exertion after being subjected to heat for long periods, but for bolts and studs used for furnaces or other equipment subjected to protracted heat. **T-12-50**

New Dust Collector

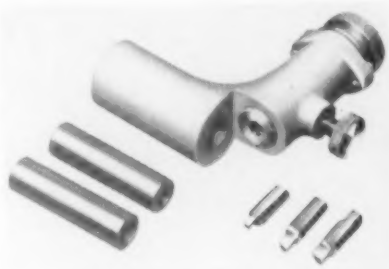
A dust collector, designed for industrial uses and called the **MICRO-COLLECTOR**, by *Pulverizing Machinery Company*, 202 Chatham Rd., Summit, N. J., incorporates hard-pressed felt in combination with a hollow, annular blow ring to filter dust from air and gasses. It is claimed to recover practically 100% of most solids. **T-12-51**

Til-Table by Lyon-Raymond



A **TILTING TABLE**, called the "Til-Table," by the *Lyon-Raymond Corporation*, 3454 Madison St., Greene, N. Y., can be adjusted vertically, by means of hydraulic lift, and tilted to any desired angle, for straight-line or sloping passage of sheets or stampings to and from presses. Portable and versatile, it should prove especially useful in plants handling sheet stock in quantity. **T-12-52**

Converter for Turning



A new metal turning and cutting tool, called the **TRU-TURN**, by *Millholland Screw Products Company*, 130 West 13th, St., Indianapolis 2, Ind., can be used to convert drill presses and woodworking lathes into metal cutting turning machines. Provided with a built-in micrometer tool adjustment, and designed to handle bar stock up to $\frac{1}{2}$" dia., the tool can also be used for production frazing of wood and metal. **T-12-53**

Precision Guide Pin Bushings

New low friction, heavy duty precision **GUIDE PIN BUSHINGS**, offering the advantages of a basic hard steel body and a special bearing bronze liner electrotypically alloyed with Indium, are announced by *Standard Machinery Company*, Providence, R. I.

Incorporating indented spherical pockets, for retention of lubricant, the bushings will withstand pressures at which lubrication ordinarily suspends and scuffing and scoring occurs. The liners are installed under pressure and accurately sized, by burnishing, for precise fit with superfinished guide pin bushings. **T-12-54**

ThredKut *

INCREASED OUTPUT 4 to 1

. . . reports
JOHN L. MOROSINI
D. A. Stuart Oil Co.
Representative

"Prior to using THREDKUT,* this customer had tried several types of cutting oil in tapping 1½" dia. x 1" holes in very tough cast steel, with a maximum production of 50 tapped holes before sharpening was necessary. On switching to THREDKUT,* output immediately increased to 200 tapped holes between sharpenings. Here is another instance where THREDKUT* demonstrated its well-established reputation for licking a tough job."

John L. Morosini

ThredKut *

. . . Stuart's THREDKUT is a unique cutting oil carefully manufactured to insure the maximum benefits from controlled chemical activity. Its outstanding performance on really tough jobs has long been recognized and its flexibility proved through exceedingly widespread use. The many time-tested values built into THREDKUT are serving the leaders of the metal-working industry, increasing efficiency and reducing costs.

Ask to have a Stuart Service Engineer discuss your cutting fluid requirements. THREDKUT literature available on request.

STUART *service goes with every barrel*

WRITE FOR DETAILS

D. A. Stuart Oil Co.

2727-49 South Troy Street, Chicago 23, Ill.

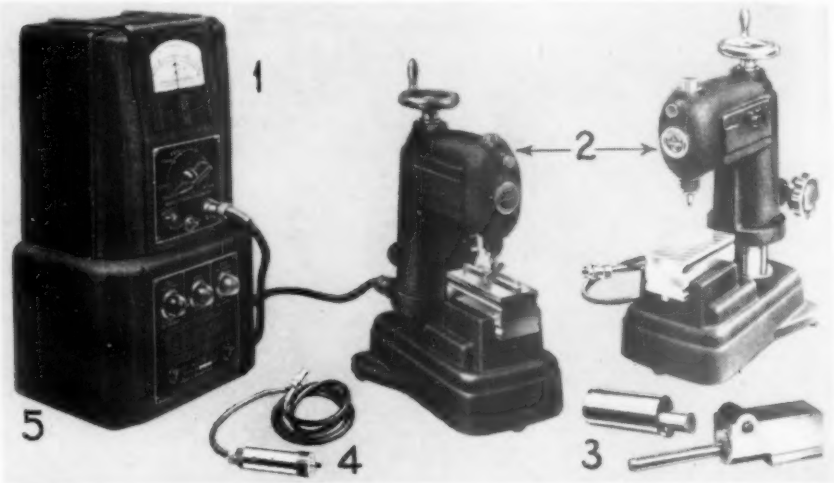
Electronic Gages by B & S

New **ELECTRONIC MEASURING EQUIPMENT,** announced by the *Brown & Sharpe Mfg. Company,* Providence, R. I., has unusual features of design and application that facilitate the taking of extremely close measurements with easier control of quality.

Included in the ensemble is Amplifier No. 950 (No. 1 in montage), featuring simplified settings from .0001" to .00001". A separate unit, with heat generating equipment divorced from the actual measuring apparatus to prevent temperature drift, its graduation selector can be set for readings in .0001", .00005", .000025", .00002" and .00001".

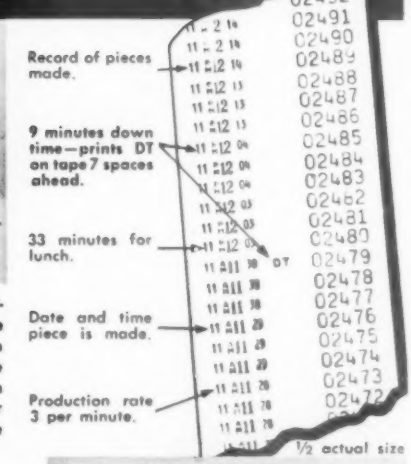
The external Comparator 951 (No. 2) has a range from 0 to 4" and measures by .0001" to .00001". Only one master is required. The Internal Comparator Attachment (No. 3) is interchangeable with the anvil and permits measurement .0001" to .00001" at range ½" to 2".

The Gage Head Cartridge No. 953 (No. 4) also has range .0001" to .00001". Frictionless, and dust and moisture proof, its compact body permits an infinite range of applications, with all measurements read on the Amplifier. A Signal Light Attachment (No. 5) has 3 glow lamps signaling undersize, oversize and "go". The Equipment is fully described in a catalog. T-12-55



FOOLPROOF COUNTING OF MACHINE PRODUCTION

CUTS COSTS



½ actual size

Operators can't count empty cycles — LECTRO-COUNT* only records cycles under load. At the right is illustrated the record you receive. Down time is recorded, also rate of production, minute and date. Remote installation in the production control department or any other location of your choosing. Can be set to provide for multiple operations.

LECTRO-COUNT* is the ideal counter for stamping presses, forge hammers, screw machines, drill presses and a host of other machines.

WRITE FOR LITERATURE AND LATEST DATA

Mention the type of machine, and the operation performed to help us determine if LECTRO-COUNT* is applicable.

*Pat. applied for

FEATURES

- ★ Remote installation.
- ★ Controls and Recorder pre-set and locked.
- ★ Permanent tape record of daily operation.
- ★ No empty cycles or false counts.
- ★ Voltmeter will indicate dull tools, tight bearings, improper steel.

ELECTRONICS DIVISION
LANSING ENGINEERING COMPANY
733 E. KALAMAZOO ST. LANSING 12, MICHIGAN

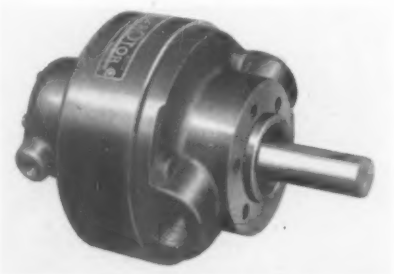
Weltronic Water Saver

A new **WATER SAVER**, by *Weltronic Company*, 19514 W 8 Mile Road, Detroit 13, is designed to relieve the operator from shutting off the cooling water on any type of welding machine. Two control relays, and a solenoid operated water valve, are de-energized if the welding machine is shut off longer than 30, 60 or 90 seconds—the three time ranges available. On starting the machine, flow is instantly reversed. Thus, the device cuts water bills and eases overload disposal systems in addition to saving on pumps and a reduction of sweating, with resultant corrosion.

T-12-56

Hydraulic Motors by G-M

HYDRAULIC MOTORS, in sizes up to 8.7 h.p., have been added to the line of hydraulic devices manufactured by *Gerotor-May Corp'n*, Maryland Ave., and Oliver Sts., Baltimore 3, Md. The line already includes a wide range of pumps, pump units, valves, and cylinders. Embodying the basic Gerotor principle with its low relative speed of the two elements, the newly developed motors are said to efficiently convert hydraulic power into rotary power.



These motors can be stalled under load without damage, operated safely in explosive and corrosive atmospheres, and installed in confined spaces. Also, their low rotational inertia permits infinite, rapid changes in shaft speed and direction. The motors are available in model ME and MH (shown), each with plain, base, or flange mounting for direct coupling, belt, chain, or gear drive.

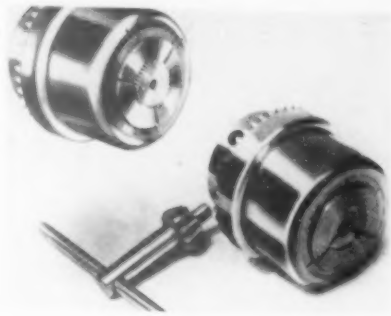
T-12-57

Precision Collet Chuck

A new small-lathe **PRECISION CHUCK**—named the Bordjaw—by the *Universal Machine Division* of the Baird Associates, Cambridge, Mass., is presently made for lathes having threaded nose spindles $1\frac{1}{2}$"-8 thd. The geared closing ring is operated by a key for firm gripping.

While similar in many ways to a conventional collet chuck, it does not draw back when closed. The only movement is lateral. The chuck can be bored and faced, after machining, and may then be removed and replaced without appreciable loss of accuracy. Jaws are cast iron and therefore inexpensive, and may be machined for special diameters or shapes, or to hold very thin walled parts.

T-12-58



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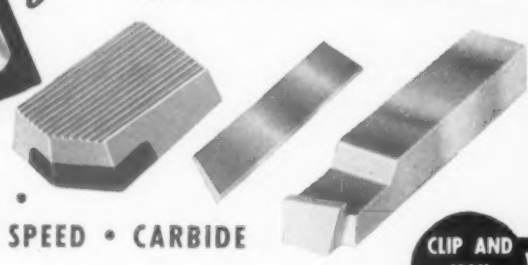

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North East West South in Industry

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Keep Your Machines Running!

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Machinery parts made of HAYNES STELLITE alloy help to keep your equipment operating at full capacity longer . . . and at lower cost. Because of its unique combination of properties, HAYNES STELLITE alloy resists severe abrasion, corrosion, erosion, and heat. This means long, trouble-free life for your machines and equipment . . . reduced maintenance cost . . . full production schedules with a minimum of shutdowns for repairs and replacements.

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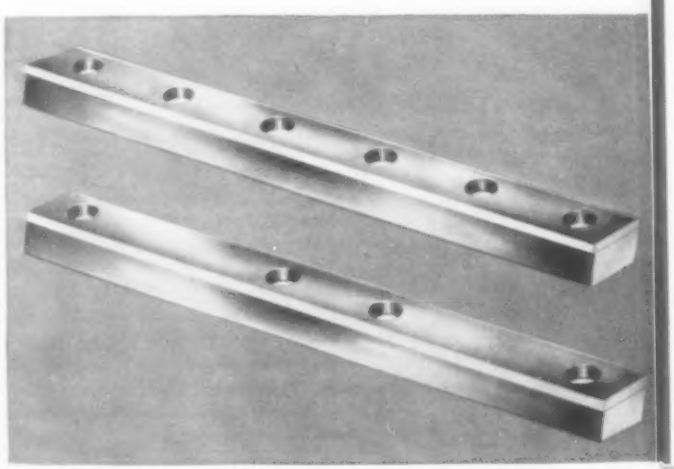

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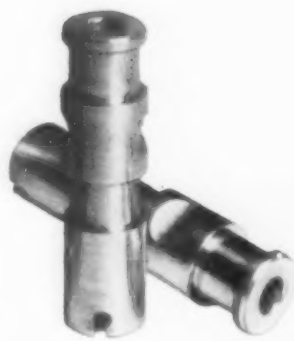

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Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

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Chicago—Cleveland—Detroit—Houston

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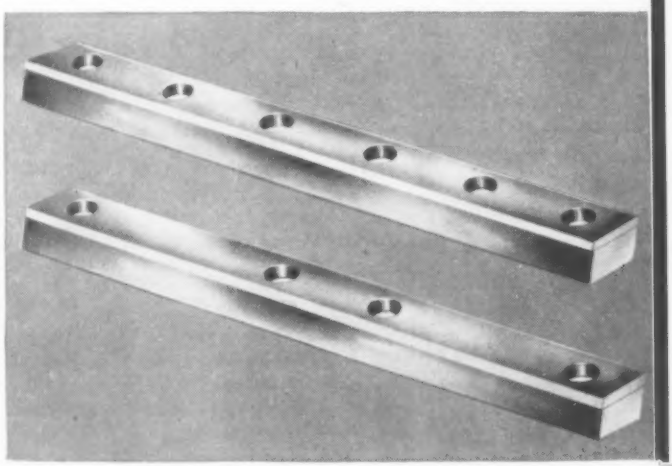

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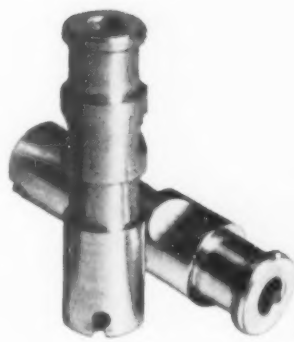

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Keep abreast of current developments—know what new tools are being marketed to increase production and step up efficiency—turn back now to the start of the Tools of Today feature for this month. Further information on any or all of the items shown can be obtained by circling the corresponding numbers on the form below, and mailing it to *The Tool Engineer*.

This month, fifty-eight different items are described, covering every type of shop operation. Many of them are new products which alert plants wil lemploy immediately to combat today's rising production costs. Others will be of tremendous help in attaining new heights of production accuracy. In every case, you will find "Tools of Today" worthy of your attention and an aid in keeping you abreast of the constant flow of new machines and appliances which are being placed on the market.

For your protection, "Tools of Today" items are checked and re-checked by the technical editors of *The Tool Engineer* so that performance data and other information will be accurate and dependable.

Tools of Today Department
THE TOOL ENGINEER
550 West Lafayette Blvd.,
Detroit 26, Michigan

Gentlemen:

Please send me further information on the following *Tools of Today* items which I have checked:

T-12-1	T-12-2	T-12-3	T-12-4	T-12-5	T-12-6
T-12-7	T-12-8	T-12-9	T-12-10	T-12-11	T-12-12
T-12-13	T-12-14	T-12-15	T-12-16	T-12-17	T-12-18
T-12-19	T-12-20	T-12-21	T-12-22	T-12-23	T-12-24
T-12-25	T-12-26	T-12-27	T-12-28	T-12-29	T-12-30
T-12-31	T-12-32	T-12-33	T-12-34	T-12-35	T-12-36
T-12-37	T-12-38	T-12-39	T-12-40	T-12-41	T-12-42
T-12-43	T-12-44	T-12-45	T-12-46	T-12-47	T-12-48
T-12-49	T-12-50	T-12-51	T-12-52	T-12-53	T-12-54
T-12-55	T-12-56	T-12-57	T-12-58		

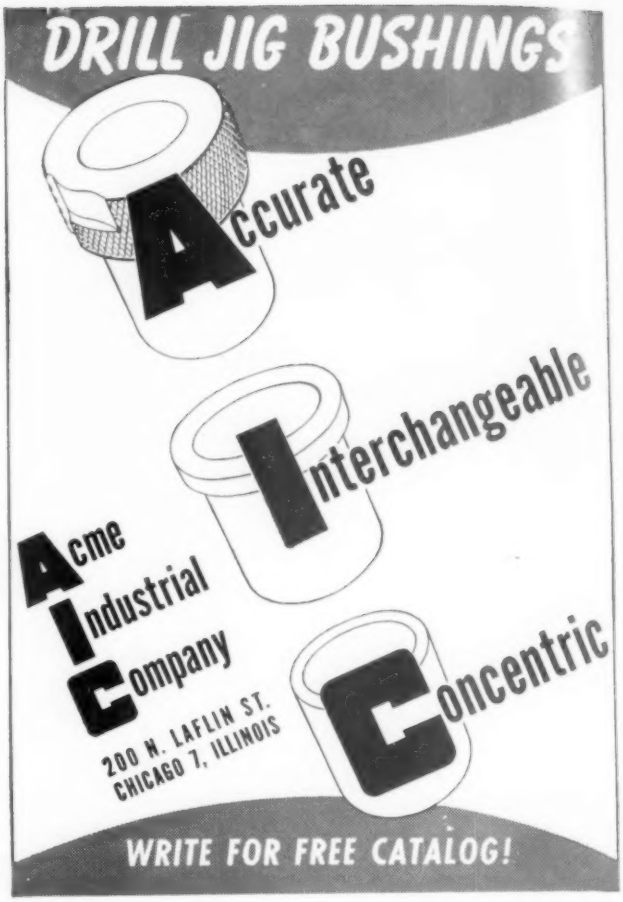
Name .....

Position .....

Firm .....

Address.....

City.....State.....

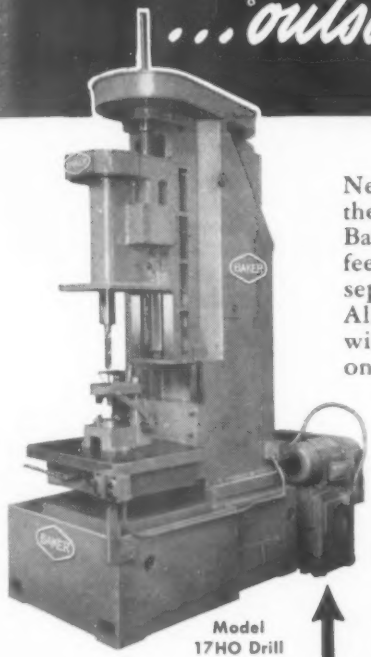


Adjustable
MULTI-DRILL
for Production Drilling
9" DRILLING AREA
—AVAILABLE WITH 2 TO 8 SPINDLES
• Designed for accurate, high speed production drilling
• RUGGED CONSTRUCTION
• Quick, easy adjustments to any hole pattern on or within a 9" circle; 1/2" minimum center distances; Drill sizes 1/32" to 3/8"
• Special adaptations available.
MULTI-DRILLS are made in other sizes and models.
Write for details and name of your nearest Distributor.
Model 900
Locater arms are designed for fast, easy adjustment
—FITS ANY DRILL PRESS
Dependable Performance... proven by industry
COMMANDER MFG. CO.
4232 W. KINZIE STREET
CHICAGO 24, ILLINOIS

It's here...Versatile BAKER

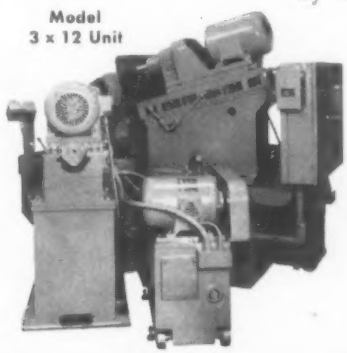
MOBILE HYDRAULIC FEED POWER UNIT

...outside the machine base!

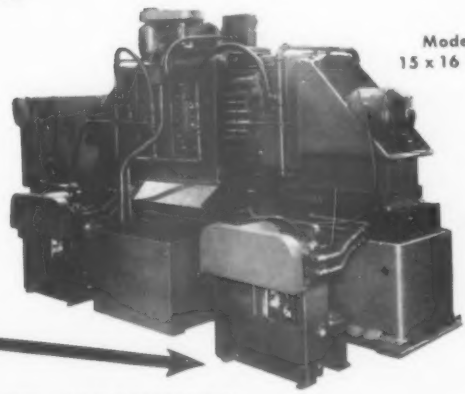


Model
17HO Drill

New Baker Mobile Hydraulic Feed Power Unit is designed for use with the three new Baker models illustrated. These new models include Baker 17HO hydraulic feed drill and Baker 3 x 12 and 15 x 16 hydraulic feed units for Special Machine application. The power unit is completely separate from the machine and requires only 19¼" x 31" of floor space All the advantages of the permanent type hydraulic system are included, with the added utility provided by a mobile base. Baker Unit is mounted on casters and connected to the operating cylinder of the machine by only two high-pressure hose lines. Lines are joined by self-sealing couplings which permit breaking the line without loss of hydraulic fluid or influx of air into the hydraulic system. The self-sealing connectors, together with the mobile base on casters, permit an exchange of units whenever desirable with a negligible loss of production time. For more information on the Baker Mobile Power Unit, write for circular No. 70242.



Model
3 x 12 Unit



Model
15 x 16 Unit

BAKER MACHINERY...
ENGINEERED FOR PRODUCTIVITY
SINCE 1867

BAKER BROTHERS-Inc. TOLEDO OHIO
DRILLING - BORING - TAPPING AND KEYSEATING MACHINES

Boost Output per grind 185% on turnbuckles

(plus 33% more grinds per tap)

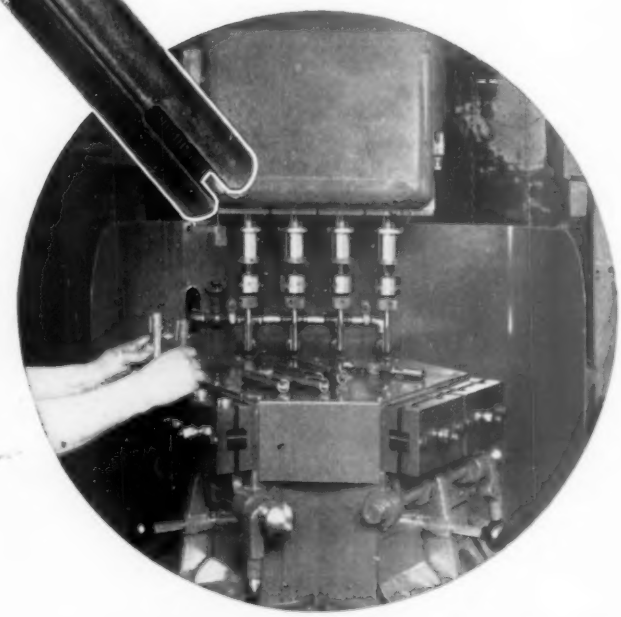
Condition of hole: un-drilled.
Material: SAE 1020 cold-rolled flat stock rolled to shape.
Stock thickness: 0.125 inches.
Length of full thread: 2¼ inches.

The average high speed steel tap produced some 175 pieces in this operation before re-grinding was necessary.

Taps made of "M-11" (Detroit Tap's exclusive chrome-cobalt HSS) however, average 500 finished turnbuckles per grind. In addition, it was found possible to re-sharpen the "M-11" taps 8 times as against 6 for conventional HSS.

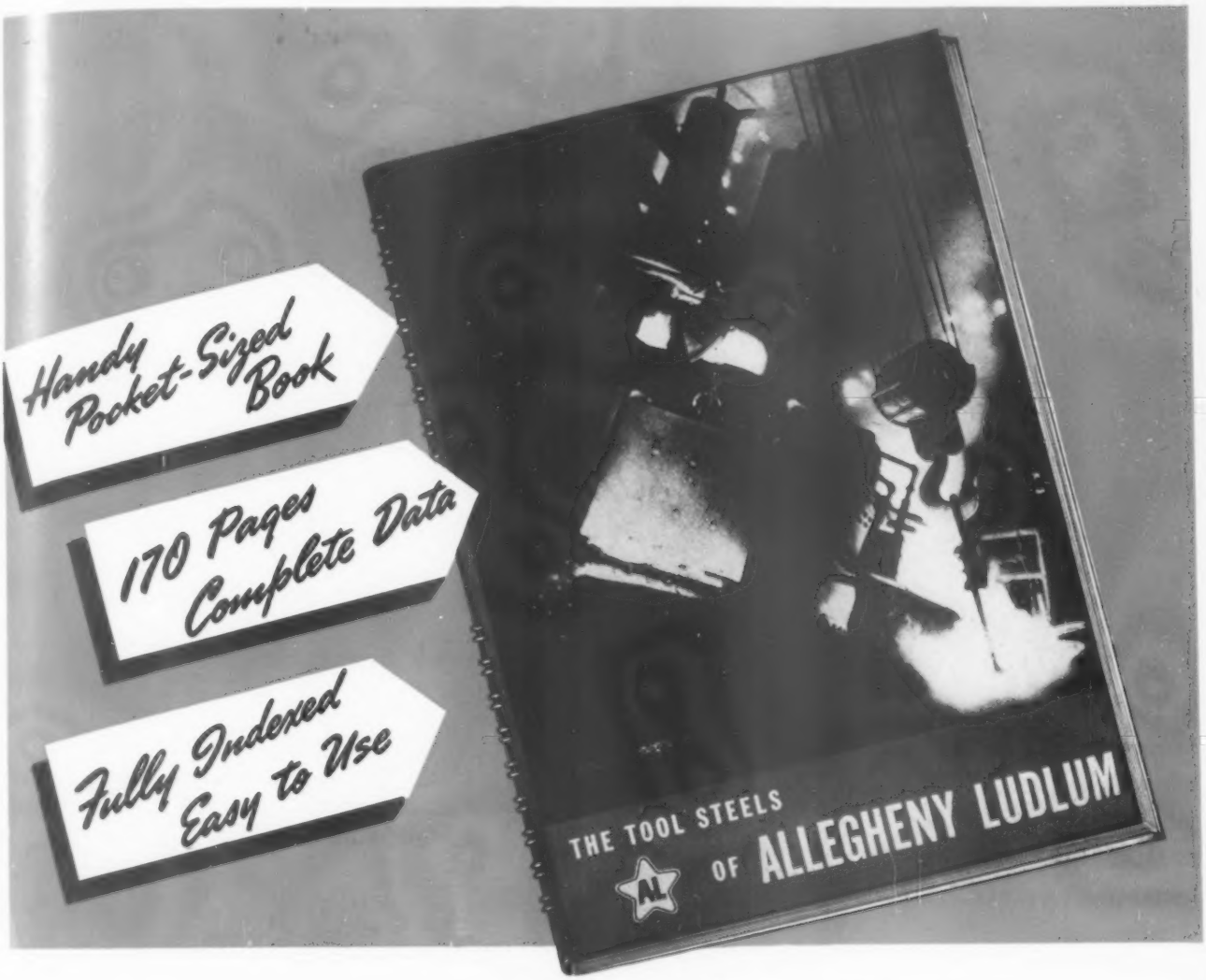
Equipment now used to produce some 12,000 parts per machine per 24 hour day are two specially designed "Detroit" 4-tap multiple head lead-screw machines with indexing fixtures, having automatic clamping, automatic unloading and simple manual loading. Spindle speed is 250 RPM while tapping, 500 RPM for backing out. Taps are 11/16" – 18 RH and LH, and of course are "M-11".

***M-11 steel is used exclusively in Detroit taps, thread milling cutters and thread plug gages.**



The reason why taps of M-11 steel* give such outstanding performance is that the steel has higher abrasion resistance (longer life); higher toughness with hardness (less chance of breakage or chipping); higher red hardness (efficient tapping at higher speeds); and higher torsional strength (greater resistance to twisting and breakage). Yet they cost no more.

DETROIT
TAP & TOOL CO.
8432 BUTLER AVE. • DETROIT 11, U.S.A.



THE ANSWERS TO ALL YOUR NEEDS IN

TOOL AND DIE STEELS . . .

- ★ HIGH SPEED STEELS
- ★ HOT WORK STEELS
- ★ SHOCK RESISTING STEELS
- ★ COLD WORK STEELS
- ★ CARBON STEELS
- ★ HIGH SPEED AND TOOL STEEL FORGINGS
- ★ CAST-TO-SHAPE TOOL STEELS
- ★ COMPOSITE DIE STEELS

TO MEET ANY REQUIREMENTS

TODAY—and for a long time to come—the premium on production cost-saving is greater than ever before. Match up each one of your machine operations with the tool or die steel that will do the job faster, better, or with less "down" time. This new booklet gives you complete information on the exceptionally large family of Allegheny Ludlum Tool Steels—invaluable data on properties, uses, selection and handling that every production man should have.

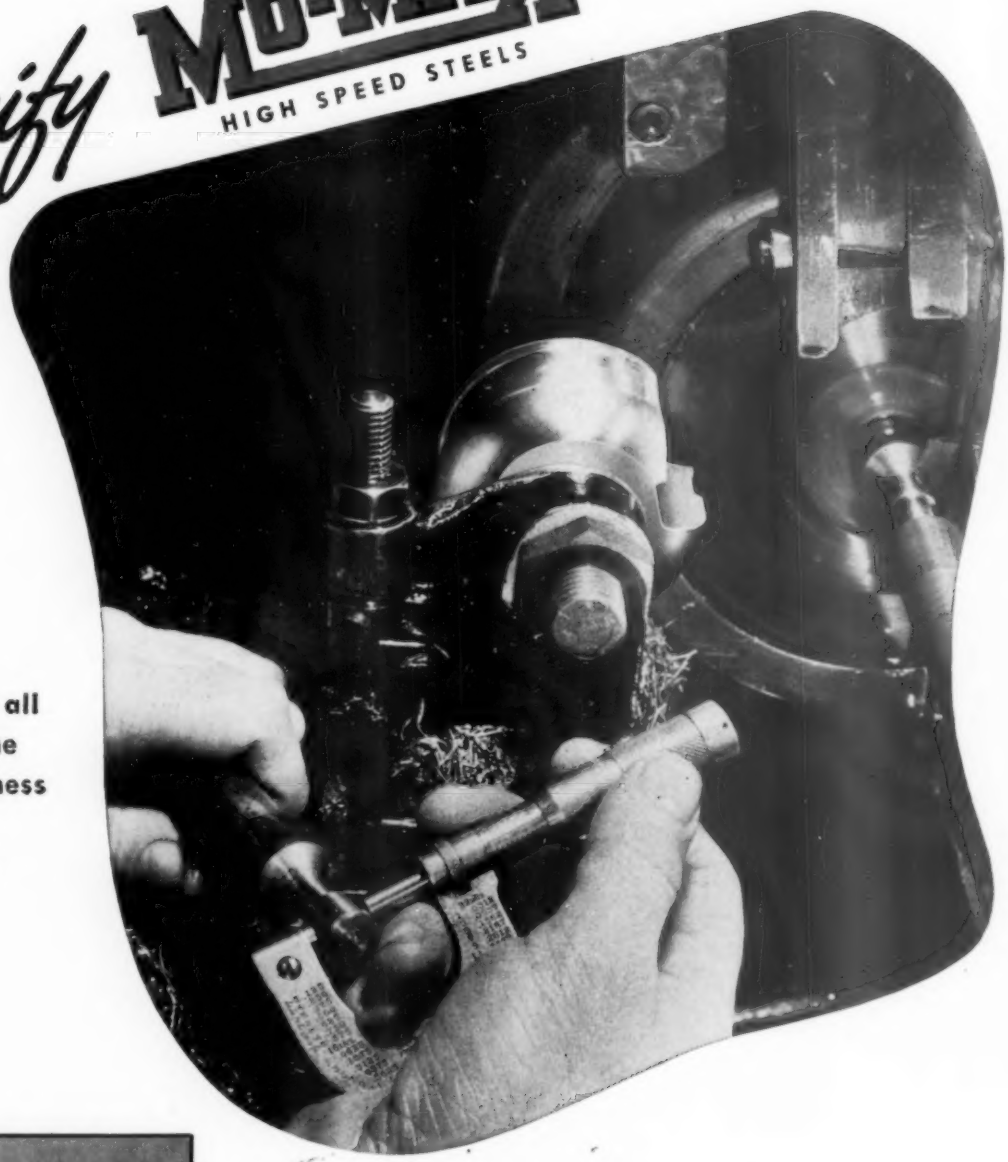
write for your copy. . . **Address Dept.** TE-60

ALLEGHENY LUDLUM

STEEL CORPORATION · General Offices, Pittsburgh 22, Pa.

Pioneer in Specialloy Steels

Specify MO-MAX HIGH SPEED STEELS



In circular and flat forming tools, as in all other cutting tools, the toughness and hardness of MO-MAX assure better performance.

Buyer's Guide to Brands of MO-MAX

"LMW"	Allegheny Ludlum Steel Corporation
"MONICAN"	Atlas Steels Limited
"BETHLEHEM HM"	Bethlehem Steel Company
"MO-CUT"	Broeburn Alloy Steel Corporation
"STAR MAX"	Carpenter Steel Company
"MOLITE M-1"	Columbia Tool Steel Company
"REX T-MO"	Crucible Steel Company of America
"DI-MOL"	Henry Disston & Sons, Inc.
"HI-MO"	Firth-Sterling Steel Company
"REX T-MO"	Halcomb Steel Company
"MOGUL"	Jessop Steel Company
"YATMO"	Latrobe Electric Steel Company
"MIDMAX"	The Midvale Company
"S. T. M."	Simonds Saw & Steel Company
"MO-TUNG"	Universal-Cyclops Steel Corporation
"8-N-2"	Vanadium-Alloys Steel Company
"VUL-MO"	Vulcan Crucible Steel Company

Only MO-MAX GIVES YOU *ALL* THESE ADVANTAGES

1. MO-MAX has superior cutting qualities.
2. The machinability of MO-MAX is unexcelled.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel.
4. MO-MAX is available in a standardized composition; also in cobalt and high vanadium varieties for special high speed steel requirements.
5. For 14 years MO-MAX has demonstrated its superiority in all types of cutting tools.

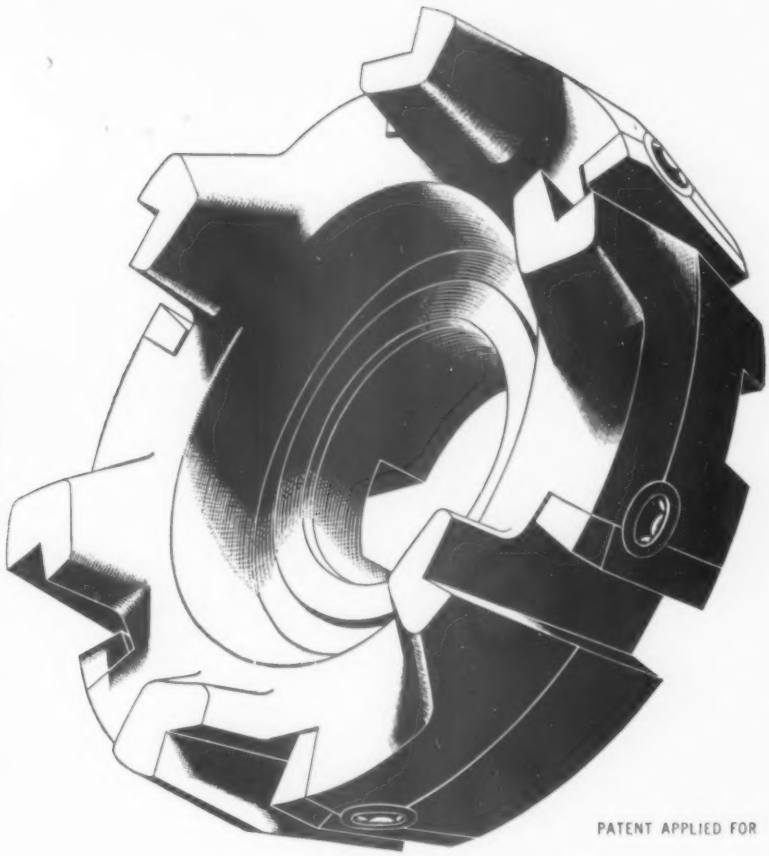
Learn all the facts! **Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.**

THE CLEVELAND TWIST DRILL COMPANY

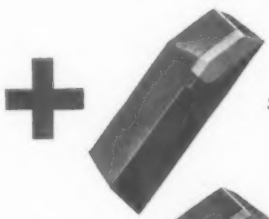
1248 East 49th Street • Cleveland 14, Ohio

NOW

you can use the SAME cutter body

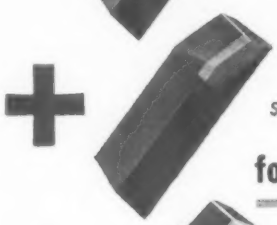


PATENT APPLIED FOR



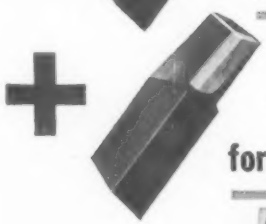
STANDARD BLADES MX-100

for cutting steel



STANDARD BLADES MX-200

for cutting cast iron



STANDARD BLADES MX-300

for non-ferrous metals

Once the blades are slipped in and lock screws tightened, your milling cutter is ready to go to work, as blades are furnished with all clearance angles precision-ground. Blades may be re-sharpened individually on a carbide grinder and quickly reassembled in the body, or the assembled cutter may be re-sharpened in the conventional manner on a cutter grinder. Write for illustrated folder which gives complete data and prices.

The GAIRING

E-CON-O-MILL

A New Carbide Face Mill Made in Standard Sizes 5-inch Diameter and over

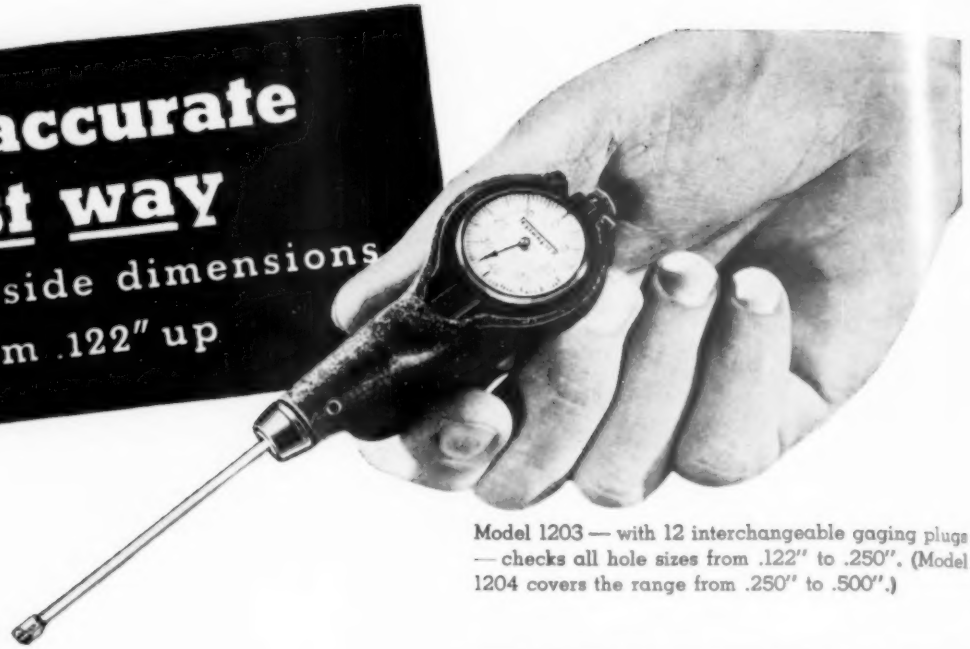
REDUCE DOWN-TIME OF YOUR MACHINES

CUT DOWN YOUR TOOL INVENTORY

The Gairing Tool Company, 21223 Hoover Road, Detroit, Michigan

The accurate fast way

to gage inside dimensions from .122" up



Model 1203 — with 12 interchangeable gaging plugs — checks all hole sizes from .122" to .250". (Model 1204 covers the range from .250" to .500".)

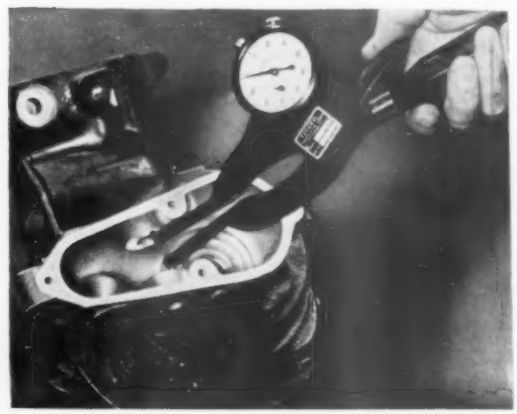
FEDERAL

Why stick to traditional methods of gaging inside dimensions, when an *Indicating* Gage gives more accurate results—with greater speed and positiveness?

Federal offers a Dial Indicator Gage exactly suited to checking any inside dimension from .122" up to 12.665". The recess may be shallow or deep; the opening offset or even blind. Roundness, taper or other eccentricities can be measured throughout the total depth.

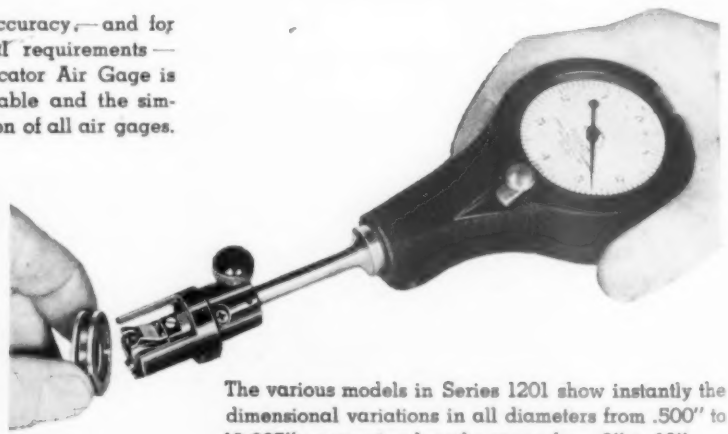
The reading on the Dial Indicator is immediately visible; the exact amount of variation is shown. You *know* instead of guessing.

The Federal line comprises many stock models of various types for gaging inside dimensions. Federal Engineers have also designed more than 10,000 special gages to meet unusual conditions, including gages to check several dimensions simultaneously. We invite you to write for illustrated Bulletin No. 105.



Model 149 Caliper Type Gages are adaptable — with arms built to specifications — to many uses; they are convenient and great time-savers.

For exceptional accuracy — and for certain exceptional requirements — the Federal Metricator Air Gage is both highly adaptable and the simplest in construction of all air gages.

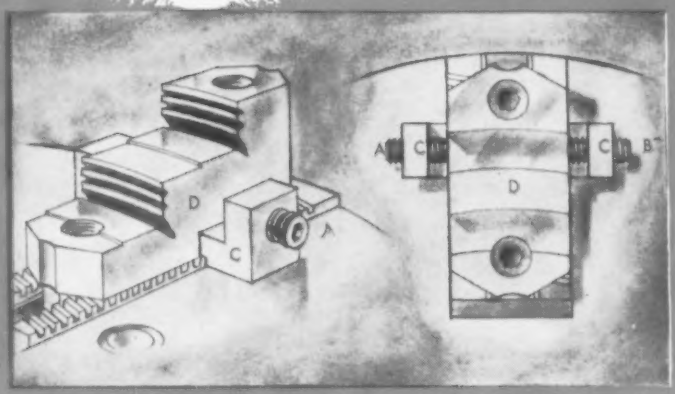


The various models in Series 1201 show instantly the dimensional variations in all diameters from .500" to 12.665"; measuring lengths range from 3" to 12".

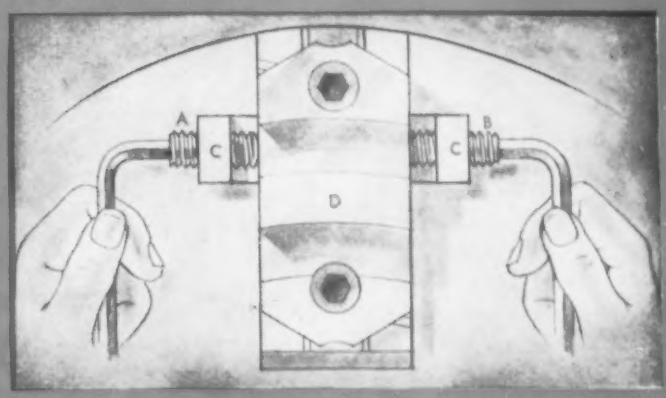
FEDERAL PRODUCTS CORPORATION
1144 EDDY STREET • PROVIDENCE 1, R. I.

● Dimensional Dial Indicators and Indicating Gages — mechanical, electronic, air, multi-dimensional • Automatic Sorting • Dimensional Machine Control • Combinations of these methods

CUSHMAN "ACCRALOCK"



"Accralock" adjustments are obtained by loosening screw "A" and tightening screw "B," or vice versa, which causes key "C" to move to the right or to the left. This causes jaw "D" to move outward or inward under very precise control.



One full turn of the screws will move the jaw in or out .010". It is evident therefore, that accuracy of adjustment as close as .001" is easily possible. After adjustment has been made, tightening both screws positively locks the jaw in position.

PRECISE ★ POSITIVE ★ MINUTE SAVING

Power chuck jaw adjustment

One of the most important of recent developments in the chuck field.

1. Positive adjustment of top jaws to super-precision accuracy.
2. Simple and easy to manipulate.
3. Few parts, with little or no wear.
4. Assurance of positive rigidity and safety under heaviest loads.

A most important "plus" to the time and cost savings possible through the use of Cushman Power Chucks.

An exclusive feature of

CUSHMAN
SERRATED ADJUSTABLE JAW
POWER CHUCKS

Power chucking devices enable operators to do better work and more work with far less fatigue. Write for your copy of the new catalog PO-62 describing this equipment in detail.

THE CUSHMAN CHUCK COMPANY
HARTFORD 2, CONNECTICUT

Reduce the COST OF TOOLING

You can convert spindles to larger or smaller tapers—and extend the spindles in your present Drill Presses, Radial Drills, Turret Lathes, Boring Mills, etc.—to utilize their productive capacity to a greater extent.

IMMEDIATE DELIVERY
ON ALL POPULAR SIZES

LONGER WEAR AND BETTER PERFORMANCE

Made to exact specifications. The tang and hole ends are heat-treated for longer wear and maintenance of concentricity. They will outlast the ordinary soft sockets and perform with greater accuracy.

FURNISHED WITH MORSE TAPER HOLES AND SHANKS *Three Series* LONG • MEDIUM • SHORT

For details see page 215 in Scully-Jones Tool Engineering Manual 500 which shows over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Write for a folder on Extension Sockets.

Scully-Jones AND COMPANY

1915 SOUTH ROCKWELL STREET, CHICAGO 8, ILLINOIS

2489

FIRTHALOY

"THE STANDARD CARBIDE"

Firthaloy

brings to your mill these advantages—

- machine speed-up
- minimum down-time
- longer runs
- maximum die life
- uniform quality of products—

the essentials of operating economy

Call

Firth Sterling

STEEL & CARBIDE CORPORATION

McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH

CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES

Another HYPRO Exclusive Feature—

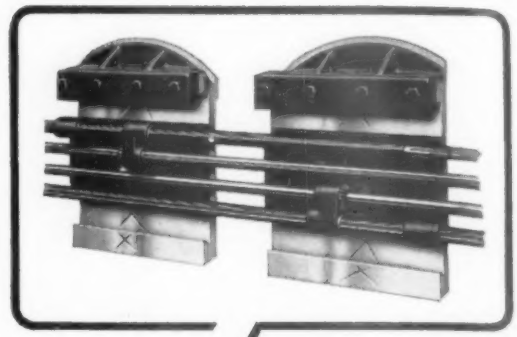
Back Lash Elimination through Double Nut Construction on Cross Feed and Down Feed Screws

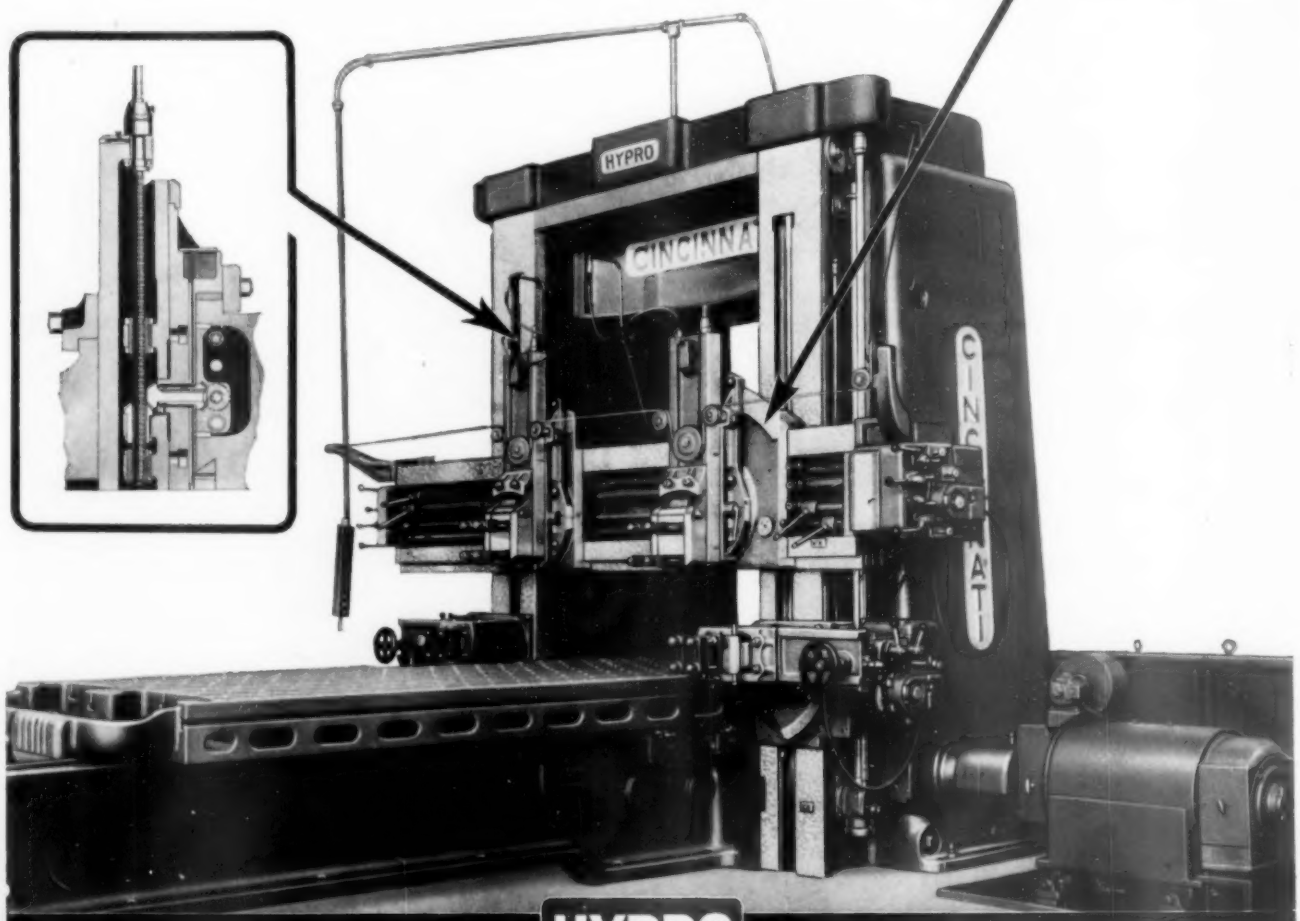
Double nuts made of a special bearing bronze are used on both saddle and down slide screws.

These nuts are held in the saddle and slide nut bearings by retaining nuts so that it is possible to keep the saddle and down slide free of backlash by adjustment of one retaining nut.

This retaining nut is accessible from the edge of the saddle and from the bottom of the rail head slide so that backlash elimination is possible without removal of any part of the head.

Each bronze nut is full length of any conventional single nut construction, thereby dividing the wear.





THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

IT CUTS GRINDING TIME

85%

New BESLY GRINDER
INCREASED OUTPUT
FROM 36 TO 240
PIECES AN HOUR

No. 372—72" Vertical Spindle Grinder with power-driven rotary fixture. In finish and flatness (within .003 inch), gear housings ground on this machine equal or surpass the best work done previously by skilled manual grinding. Rotating fixture and revolving work holders carry the castings through the grinding cycle at one revolution every 60 seconds. Four pieces are ground simultaneously. Approximately 1/32" is removed. When smaller castings are ground, two or more can be placed in each work holder.

This *new-type* Besly Grinder is typical of the design skill of Besly engineers. Developed originally to grind cast iron gear housings, it is readily adaptable to many types of production grinding. Novel use of revolving work holders in a rotating fixture steps up output more than six times as compared with the best manual grinding by experienced operators.

Consider how a "372" might offer you equal advantages. Perhaps it is the answer to your urgent problem of holding down rising production costs . . . The idea is worth discussing with a Besly engineer.

BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Illinois • Factory: Beloit, Wisconsin

Even if we split the difference . . .

These new Speed-Wet Discs are cutting 5 to 1 Better!

Actually the field engineer's report stated 4 to 6 better! Here's the "before and after" comparison. The job: grinding stove frames. Previous production average: one frame per disc. New production rate with Speed-Wet Metalite Fibre Discs: 4 to 6 frames per disc. Purchasing agent instructed: furnish "Behr-Manning only" on all future disc requisitions.

Ever since we released the new Speed-Wet Disc, we have received glowing reports like this from the field. Technically, the explanation of this extra production lies in three quality features: first, all-resin bonding for resistance to heat; second, all-Durabonded* coating for rugged grit anchorage; third, all-fibre backing for extreme flexural strength.

Thus there is every possibility that a job test of Speed-Wet Discs on your own work will improve your production too. We'll be glad to arrange it at your convenience — just write us on your company letterhead.

* *Reg. U. S. Pat. Off.*

watch for SERVICE PACKAGING

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.

No change in shape or size after hardening—
No honing or lapping necessary

. . . says Chicago Cutting Die Co.

Picture shows laminating die made from Latrobe Desegatized Brand of Olympic Die Steel

Another instance of the advantages provided by

LATROBE
DESEGATIZED
BRAND OF
Dispersed-Segregate STEELS

In the making of a lamination die, such as pictured above, the job is an exceedingly intricate one. Non-deforming characteristics are vitally important. For this reason, **CHICAGO CUTTING DIE CO.** selected Latrobe's *Desegatized Brand* of Olympic Die Steel, thus further assuring uniform quality throughout.

Being definitely free from excessive carbide segregations, Latrobe's DESEGATIZED Brand of Dispersed-Segregate Steels are extra tough, and provide a highly desired safeguard against die break-downs and irregularities. *Write for full information.*

ANALYSIS
Olympic Die Steel
C—1.50
Cr—11.50
V—1.00
Mo—.75

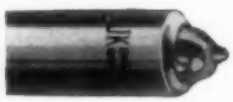
6

LATROBE ELECTRIC STEEL COMPANY • LATROBE, PENNSYLVANIA

When you check all the angles in Truing and Dressing Operations

ACCURACY ✓
SPEED ✓
LONG TOOL LIFE ✓

You, too, will find it pays to use
J.K.SMIT DIAMOND TOOLS



JKS STANDARD TOOLS

To assure uniformly successful results, the finest in diamonds, materials and workmanship are blended into every J. K. Smit Standard Tool. And you can count on *exact* dimensions for every make of grinder. In ordering, state the grinder manufacturer's name and type of machine.

JKS FORM DRESSING TOOLS

Designed to dress abrasive wheels with speed in any variety of shapes required, J. K. Smit Form Dressing Tools are made with selected diamonds that permit close tolerances, high finish and long tool life. Blade and chisel tools, cone shaped, pyramid type and other dressers with formed radii and specific included angles are available.

Write for Catalog

J. K. SMIT & SONS, Inc.

157 Chambers St., New York 7, N. Y.
6400 Tireman Ave., Detroit 4, Mich.

5108

ARMSTRONG *Carbide* TOOL HOLDERS

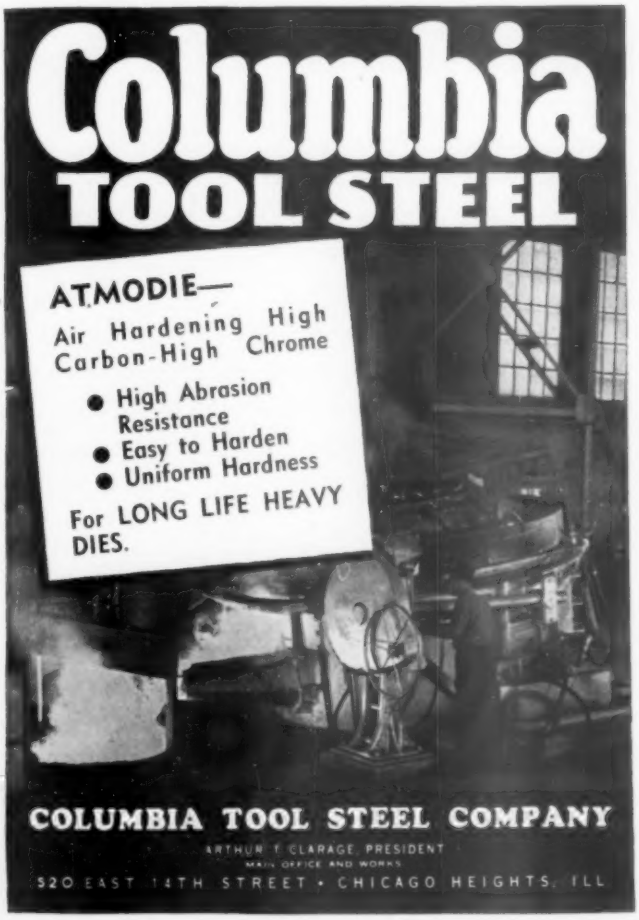
for
Higher
Speeds, and
Heavier Feeds

ARMSTRONG Carbide Tool Holders and ARMIDE (Carbide Tipped) Cutters come in cased sets for tool rooms and maintenance departments, and individually in all sizes for general machine shop and production turning. They permit not only the ready machining of sand-filled castings, the hardest and toughest steels as well as many heretofore "unmachineable" materials, but also make practical much heavier cuts and cutting speeds up to 600 f.p.m. on ordinary work. They also run from 10 to 100 times as long between regrindings.

Write for ARMSTRONG Carbide Bulletin

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
357 N. Francisco Ave., CHICAGO, U. S. A.
NEW YORK SAN FRANCISCO

Columbia TOOL STEEL



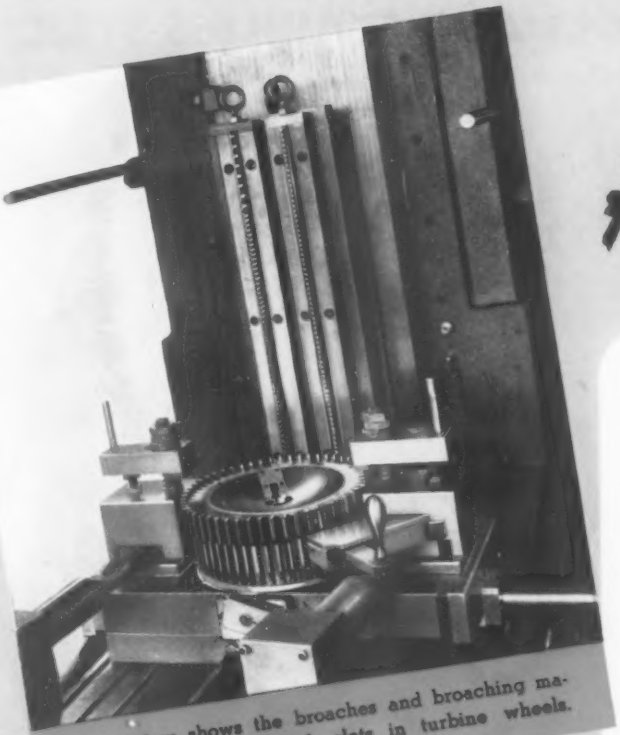
ATMODIE—
Air Hardening High Carbon-High Chrome

- High Abrasion Resistance
- Easy to Harden
- Uniform Hardness

For LONG LIFE HEAVY DIES.

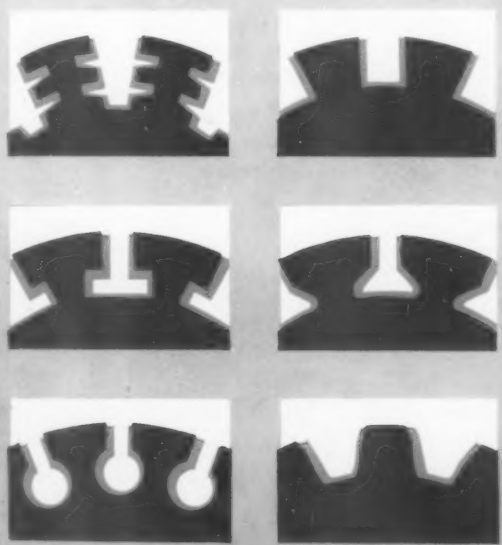
COLUMBIA TOOL STEEL COMPANY
ARTHUR T. CLARAGE, PRESIDENT
MAIN OFFICE AND WORKS
520 EAST 14TH STREET • CHICAGO HEIGHTS, ILL

Broaching PUTS TEETH IN THE JOB FASTER— *For Less!*



This view shows the broaches and broaching machine set-up to broach slots in turbine wheels.

SOME OF THE FORMS BROACHED



DETROIT BROACH COMPANY designed and manufactured the broach tooling to produce the slots around the circumference of many different turbine wheels. The result—perfect form, better finish and many more parts per hour than could be produced by any other method.

This application has lead to others where slots, or teeth, are required around the outside diameter. In every case the savings in production costs have soon paid for the tooling. Further, the "human element" is practically eliminated when the job is broached.

Call the Detroit Broach representative in your locality now for real production savings—savings that will help to beat today's rising manufacturing costs.

DETROIT *Broach* COMPANY

20201 SHERWOOD AVENUE
DETROIT 12, MICHIGAN

Report No. 6

TANTUNG TOOLS AND STAINLESS STEEL

Facing, Boring, Turning, Chamfering, Forming and Cut-off with Tantung

STAINLESS STEEL
Machine: No. 5 Warner & Swasey.
Material: 18-8 Stainless steel (welding type 304, not free machining type 303).
Stock: 2.024" O.D. x 1.306" I.D. S.S. tubing.
Part: Ferrule.
Rough Bore and Rough Turn: 151 RPM, .012" feed.
Finish Bore: 274 RPM, .0075" feed.
Face End: 151 RPM, hand feed.
45° Chamfer: 274 RPM, hand feed.
Form Radius: Plunge cut 151 RPM, .003" feed.
Cut-off: Tantung cut-off blade.
All the above tools are Tantung. After adopting Tantung, type 303 was replaced with tougher 304 stainless steel stock.
1.984
1.989
8 ACME THREAD
1.370
1.375
.0125
45°

The machining of high chrome and nickel, stainless steels, cold rolled and copper alloys, from free cutting brass to Beryllium copper has proved Tantung's superiority. In many instances, tool life is increased up to 1200%.

In machining stainless steels, Tantung's lubricating characteristic makes stainless steel chips SLIDE over the top surface without cratering the tool. Since Tantung has a much higher red hardness than H.S.S. tools and a higher transverse rupture strength than average cast alloy tools, it is ideally suited for operation under excessive vibration, shock and interrupted cuts.

Remember—don't "baby" Tantung. Tantung produces more pieces per grind at speeds and feeds far above standard H.S.S. tools.

Write today for additional information regarding the outstanding performance of Tantung drills, Keyway cutters, nonferrous and metal cutting tools.

MAKERS OF WORLD'S FINEST VR Carbides

VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS, U. S. A.

District Sales and Service in Principal Cities

AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

FOR PRECISION BORING IT'S... V-R* CARBIDES by 65,256'

V-R CARBIDE PERFORMANCE REPORT

Report No.: 1798A | **Subject: Precision Boring Practice** | **Date: 1947**

Tool: 3/8" shank type, V-R carbide boring tools.
Style: RB-34-R2A

Grade: EH

Recommended for: Steel precision boring and light finishing cuts at high speeds where close dimensional tolerances are essential.

SET-UP

Part: Split Connecting Rod.
Operation: Precision boring. Bore diameter 2.6483" plus .0000 minus .0004 by 1-5/8" long.
Material: 2340A forging at 250 brinell hardness.

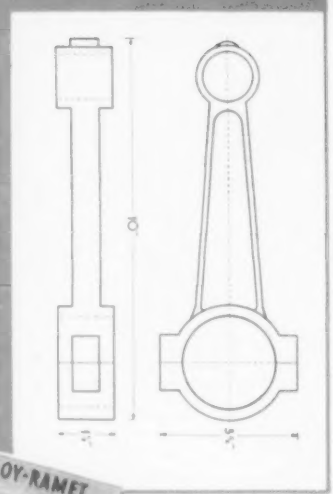
Machine: Model 1212 Excello boring machine.
Speed: 518 surface feet per minute.
Feed: 4" per minute or .005 per revolution.
Depth of Cut: .010".

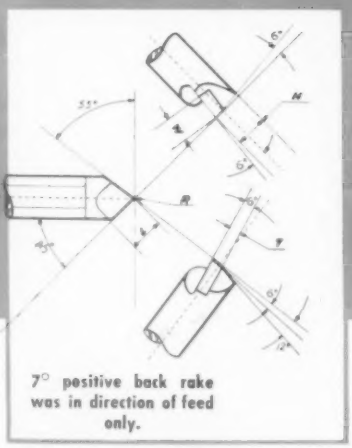
PERFORMANCE DATA:

The V-R carbide tipped boring tool machined 24 rods before any loss of rod diameter was visible on the air gage. After 24 rods, the tool was advanced .00015 and operation was continued with the same fine result.

NOTE: This means that the V-R carbide tipped boring tool machined 65,256 lineal inches (more than 1 mile) at a speed of 518 sfm, averaged 1500 interrupted cuts per minute and removed 326.40 square inches of tough metal with LESS THAN .0002 WEAR on the delicate tool radius (see illustration).

Other carbides tested averaged less than 8 rods per grind.





7° positive back rake was in direction of feed only.

MAKERS OF WORLD'S FINEST VR Carbides

Ask your nearest Vascoloy-Ramet Field Engineer about V-R carbide precision boring and machining applications TODAY! Remember, when you ask about V-R you are asking about the world's finest carbides.

* Reg. U. S. Pat. Off.

Send for your free copy of the V-R 400 Carbide Tool and Blank Catalog, 32 pages of important carbide engineering information.

VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS, U. S. A.
District Sales and Service in Principal Cities
AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

We'll stake our reputation on STANDARD Adjustable MULTIPLE SPINDLE DRILL HEADS

Low Prices • Top Quality • These Heads can be adapted on either round or flanged quill machines.

5 TYPES 56 SIZES

WRITE TODAY for 1948 catalog.

US HEADS SINCE 1915

Also manufacturers of all types of fixed center heads

UNITED STATES DRILL HEAD CO.

CINCINNATI 4, OHIO

—SHELDON makes *ALL THREE*—

These 3 precision machine tools are a necessary part of every completely tooled shop . . . a modern precision lathe with "Zero Precision" tapered roller bearings that will retain its extreme accuracy at new high operating speeds . . . a convenient back-geared shaper that embodies all major design improvements . . . a capable small milling machine that will do accurate work . . . all three are extremely moderate in price.

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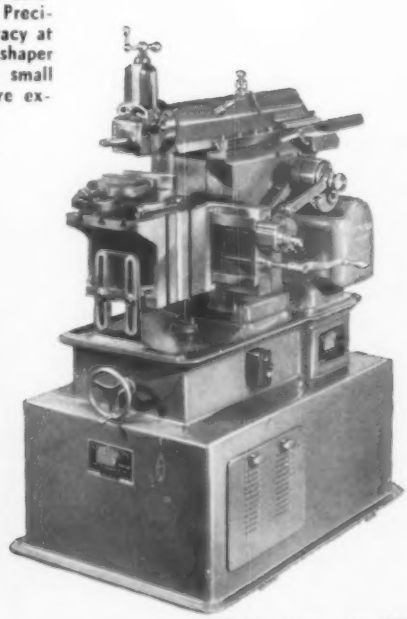
Sheldon-Vernon No. 3000P Horizontal Milling Machine

Sheldon TRB-S56 Lathe



Sheldon-Vernon No. 8000 12" Shaper

SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Milling Machines • Shapers

4229 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U. S. A.

6-TON thrust loads and 1-TON radial loads can't budge tools gripped in UNIVERSAL COLLET CHUCKS

Universal Collet Chucks grip tools TIGHT! They hold end mills, taps, drills, and reamers positively rigid under 6-TON THRUST LOADS and 1-TON RADIAL LOADS. Special design produces *precisely equalized gripping power*—not at just a few points, but ON A CONTINUOUS SURFACE. That means you can use heavier feeds and greater speeds in your machining operations when you use Universal Collet Chucks—*you can turn out more work in less time.* Universal Collet Chucks grip tool flutes, permit stubbing, which eliminates cutting drills, thereby increasing profits. The Universal Collet Chuck is tightened so easily that LOCKING EFFORT IS REDUCED 50%. For faster, more accurate milling, drilling, reaming, and tapping in your plant, it will profit you to use Universal Collet Chucks. *Write for complete information.*

UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND EFFICIENCY IN YOUR PLANT

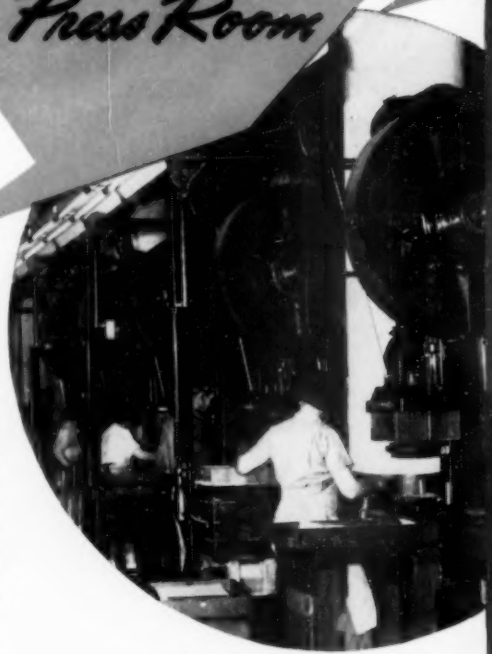
UNIVERSAL ENGINEERING COMPANY • **FRANKENMUTH, MICHIGAN**

Danly Die Sets and Die Makers' Supplies Speed Production

in the Die Shop

in the Press Room

DANLY PRECISION DOWEL PINS are accurate through their entire length . . . Diamond tested for hardness (58-60 Rockwell-C) . . . Ground to a tolerance of .0001".



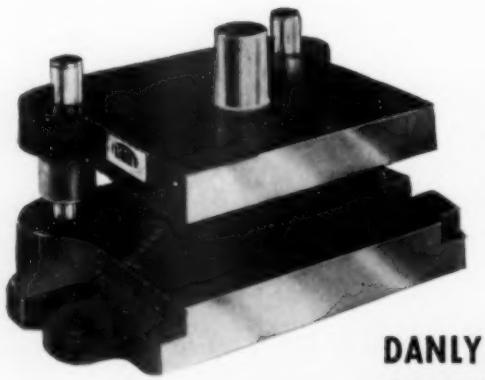
Photo—Courtesy of Croname, Inc.

DANLY KNURLED SOCKET-HEAD CAP SCREWS save time and money. The mechanic can drive the knurled head a good part of the way before using the wrench. Infinite applications—a wide range of sizes.

DANLY KWIK-KLAMP TOGGLE CLAMPS combine strong construction and simplicity of operation—used wherever quick, positive clamping action is required.

DANLY DIE SPRINGS are noted for staying power and high resistance to fatigue. Two complete lines: *Medium Pressure—High Deflection; High Pressure—Medium Deflection.*

DANLY SOCKET-HEAD STRIPPER BOLTS. Made of high-grade steel, these stripper bolts have the same knurled socket-head found in Danly Cap Screws.



DANLY DIE SETS are famed for precision and known accuracy in Die Shops and Stamping Plants everywhere. Many types and sizes in Steel, and Semi-Steel.

DANLY MACHINE SPECIALTIES, INC.

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DANLY *National Assembly*

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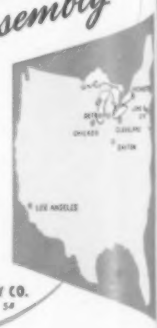
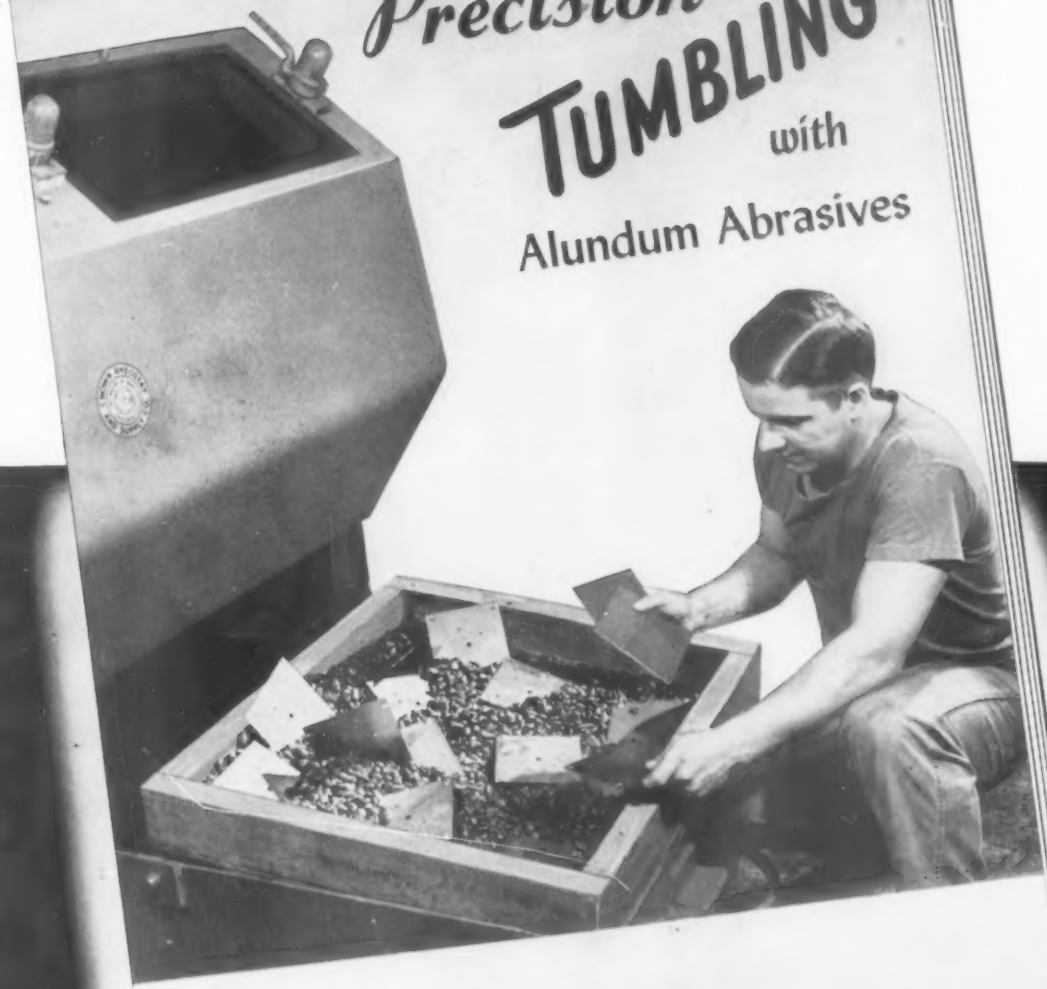
- **DUCOMMUN METALS & SUPPLY CO.** — 4890 South Alameda, Los Angeles 54



Danly Tool, Die and Gage Makers' Supplies

Precision TUMBLING with Alundum Abrasives



NORTON

Finishing metal or plastic parts? Then you'll be interested in this new, fact-packed booklet on Precision Tumbling. It's filled with accurate information on this new finishing process which is slashing finishing costs and finishing time in plants throughout the country.

NORTON COMPANY • Worcester 6, Mass.
Please send your new booklet — "Precision Tumbling with Alundum Abrasives."

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Specify "Republic"

Inspectors and Production men whose first consideration is value, invariably pick REPUBLIC GAGE as their source for gages.

For years REPUBLIC has enjoyed top rating as manufacturers of thread gages with "THAT UNSEEN EXTRA QUALITY." May we serve you?

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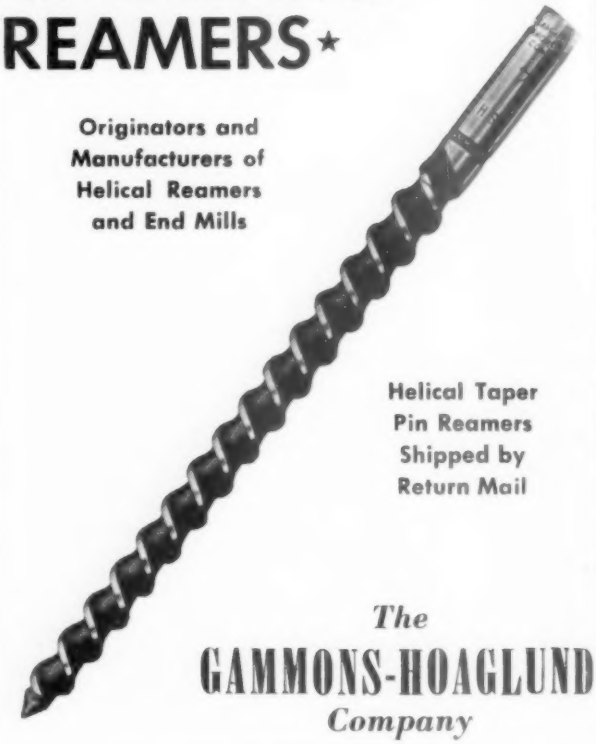
GAMMONS REAMERS★

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The
GAMMONS-HOAGLUND
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400 MAIN STREET, MANCHESTER, CONN.

"CONE-LOK" JIGS

The Woodworth "CONE-LOK" jig utilizes the full braking power of its perfectly mated male and female cones.

ACCURACY YOU CAN TRUST

- **MECHANICAL SIMPLICITY • ADAPTABILITY**
- **RUGGED CONSTRUCTION • CHIP PROTECTION**
- **SEALED LUBRICATION • MAXIMUM SAFETY**

★ CATALOG AND FULL SCALE TEMPLATES UPON REQUEST ★

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N. A. WOODWORTH CO., • SALES DIVISION
1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

Master Hobs

Master hobs made by Atlas Tool Works, Bridgeport, Conn. Bethlehem 67 Chisel tool steel was used for both hobs.

. . . of Bethlehem Tool Steel

Master hobs are fine examples of the art of the toolmaker—precision tools, often of intricate design, that exact the utmost skill of the metal craftsman. Shaped so painstakingly, these hobs are destined for drastic shocks and severe compression in the production of hobbings for die castings, plastic moldings, and other molded products.

Here's a job for a tough, shock-resisting steel . . . Bethlehem 67 Chisel tool steel. This grade combines the essential attributes for super shock-resistance—high tensile strength, hardness, and extreme toughness. 67 Chisel holds sharp corners, keeps a fine cutting edge, and resists abrasion in the most severe shock applications.

It's a natural choice for master hobs, yet it has other important uses, such as tools for chipping, calking, beading, and battering; water-cooled dies; hot-header dies; shear blades; punches; rivet sets; studs and bolts for elevated temperatures. In addition, it has many uses as a hot-work tool steel where the tool operating temperature is below 1050 F.

Typical analysis: C—0.50, Si—0.75, Cr—1.15, V—0.20, W—2.50. Easy to forge, machine, and heat-treat.

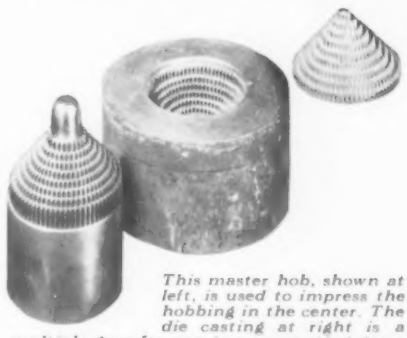
67 Chisel is ready for prompt shipment to distributors and mill customers from the Bethlehem mill depot. Get full facts now from your nearest tool steel distributor or Bethlehem district office.

Bethlehem Steel Company, Bethlehem, Pa.

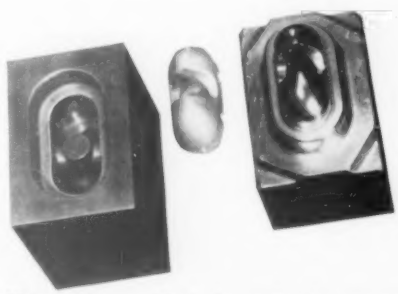
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL



This master hob, shown at left, is used to impress the hobbing in the center. The die casting at right is a multiple gear for use in a computing gasoline pump.



The plastic molding shown in the center serves as the door catch for a refrigerator. The mold at the left is an accurate reproduction of the master hob on the right.

67 Chisel . . . one of Bethlehem's Fine Tool Steels

All Lovejoy Blades for Type "A" Milling Cutters are interchangeable from 4½" to 24" in diameter

LOVEJOY Type "A" Face Milling Cutters offer complete interchangeability of H.S.S., carbide and cast alloy blades in housings from 4½" to 24" in diameter. Thus you can take advantage of Lovejoy's prompt delivery of standard blades from stock — can eliminate the need for carrying large stocks of blades yourself. This feature, plus husky, forged steel housings, plus unsurpassed ability to remove metal quickly, accurately and smoothly, makes Lovejoy Type "A" mills outstanding for production economy.

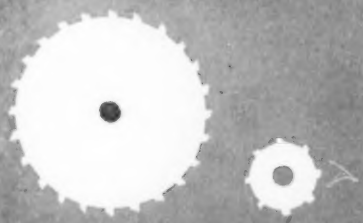
The Type "A" blades are held in the housing with the famous Lovejoy "positive-locking" device. This means that a minimum of stock must be removed when sharpening. It allows utilization of a large per cent of each blade. It holds the blades immovably, even during heavy, intermittent cuts.

Type "A" face mills are available for all standard arbor and spindle mounts, and for either positive or negative rake cutting.

See these milling cutters and the rest of the complete, modern line of Lovejoy tools at the Machine Tool Show, Booth 153.

DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.



RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A. — there is one near you.

30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.

3 to 10 times
more production than other carbides

WHAT a difference in production and costs, when you use Improved TECO Cemented Carbide! It produces 3 to 10 times more pieces than other carbides, yet costs no more. It stays on the job much longer—removes more metal—operates at higher speeds and feeds—gives a better finish.

The same TECO Grade can be used for turning, facing and boring—rough and finish cut—as well as for precision boring and reasonable intermittent cutting. When no longer used for roughing, continue to use the tool for finishing, down to the last grind. No complicated stocks—no waste.

Tool up a carbide job with Improved TECO and judge it yourself. Send details of your machining problem for recommendation. Catalog and price list on request.

TUNGSTEN ELECTRIC CORP. 570 39th ST., UNION CITY, N. J.

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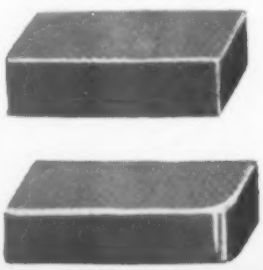
Manufacturers of
TECO CARBIDE BLANKS and TOOLS



All standard sizes and styles. When ordering any carbide tools specify "Teco —no substitute."

Another Typical Case:

Part: Motor Shaft
Material: SAE 3140 Steel
Machine: Warner-Swasey Lathe No. 2A
Operation: Turning
Diameter: 1.468″
Depth of Cut: .284″
Feed: .011″
Length of cut: 6″
Speed: 460 rpm
PIECES PER GRIND: 150
Best previous carbide production: 40 pieces

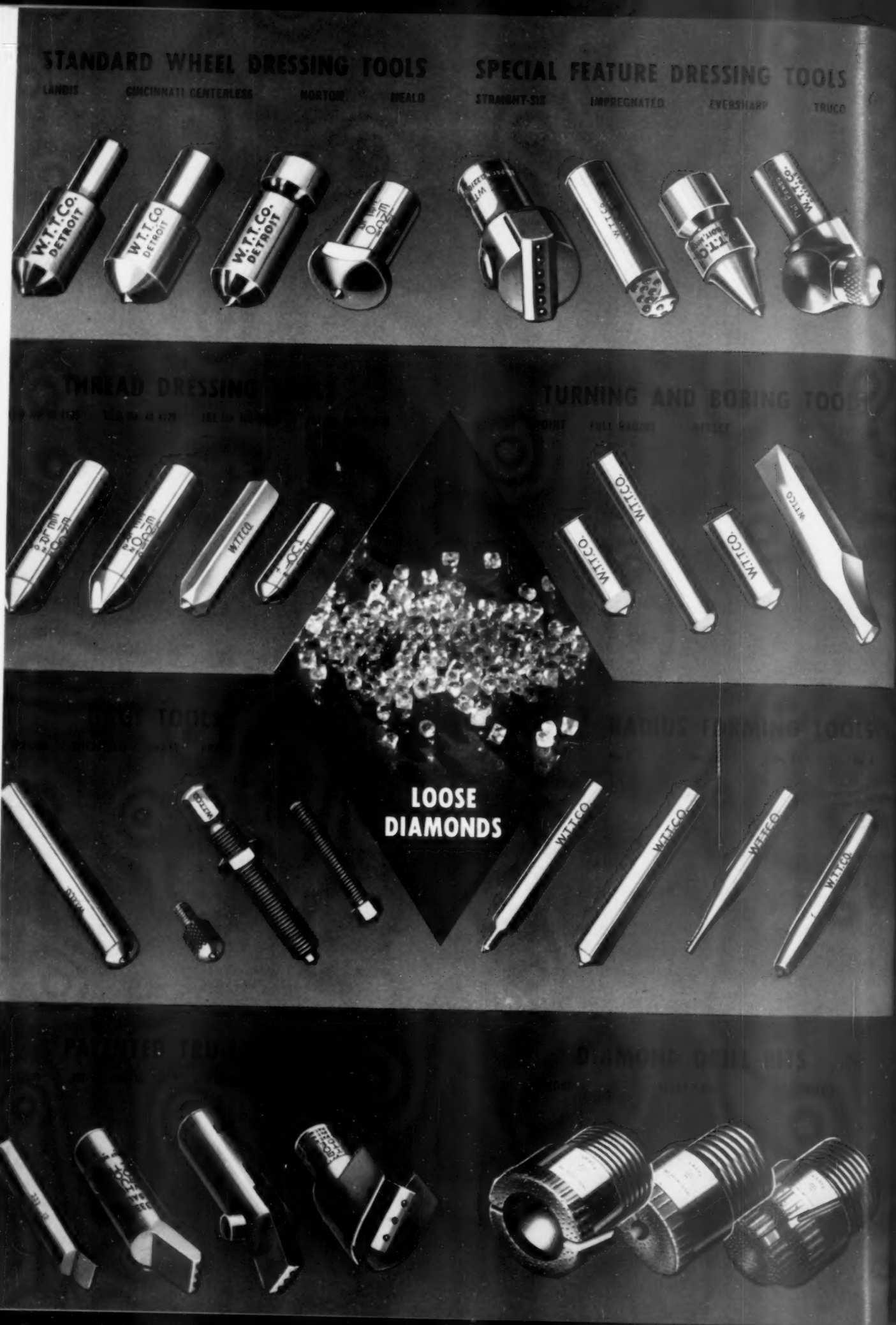
TECO Grade C. used

You get:

- ***More pieces between grinds***
- ***More grinds per tool***
- ***Less down time***
- ***Lower tool cost with***

Improved
TECO
CEMENTED CARBIDE

Manufacturers of Tungsten Carbide—from ore to finished material—for over a quarter century.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"We can guarantee our diamond tools because they are engineered to the job."

Harry O. Wallace

PRESIDENT

THIRTY-SEVEN YEARS AGO, when Wheel Trueing started in the diamond business, there were no standards of diamond tool value and guarantees were specifically avoided.

Wheel Trueing pioneered the idea of studying the job to be done, engineering the tool and the diamond to the job and guaranteeing satisfactory performance.

Consequently, for many years, Wheel Trueing customers have enjoyed the efficiency and the economy of using diamond tools scientifically matched to their work.

Our Engineering Data Sheets for supplying job information and our booklets on many types of Standard and Special diamond tools are yours for the asking. We invite your inquiries.

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Eastern Division of Wheel Trueing Tool Co.
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HEX-SOCKET SCREWS

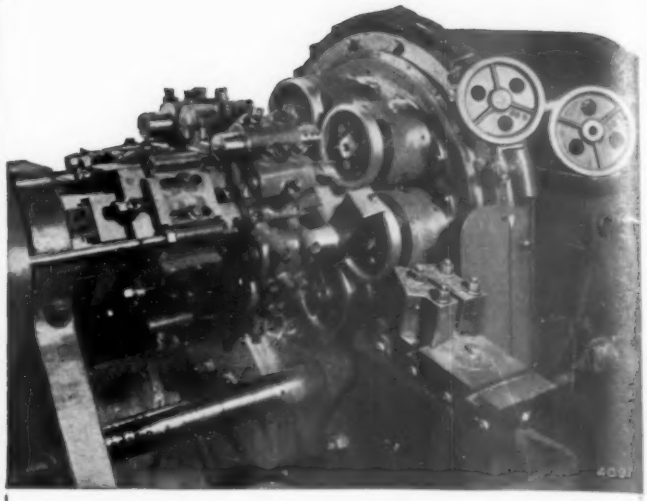
NOW CARRIED IN STOCK

A NEW ADDITION TO

THE ALLEN HEAD LINE

NON-CORRODING "ALLENS" for applications where steel is subject to excessive moisture, chemical fumes or corrosive vapors. Made of "18-8 Type" *Stainless,* non-heat treated, non-magnetic. Set screws: stock sizes #6 to ½" diameter; cap screws: #8 to ½". N. C. threads only. Class 3 fit; Allen precision fastenings. . . Order of your local Allen Distributor, or write us for samples and literature.

THE ALLEN MFG. COMPANY
HARTFORD 2, . . CONNECTICUT, U. S. A.



GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

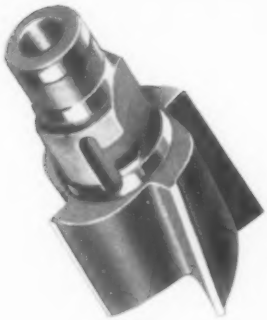
This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.



Radial Drive Counterbore

Interchangeable Pilots

Pin Drive Counterbore

STANDARD ECLIPSE TOOLS

Eclipse at all times stocks 1,000 Standard items (in 100,000 quantity) for immediate delivery to you. Let Eclipse carry your inventory of fine cutting tools!

Balanced Drive Inverted Spotfacer

Self-Centering Countersink

Interchangeable Counterbore Set

Two Piece Core Drill

Piloted Countersink

ECLIPSE COUNTERBORE CO.

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These tools are designed to fill your various Inspection and Checking needs in the Inspection, Tool Room and Production Department.

Surface Plates • Box Parallels
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Universal Right Angles
Flat Parallels • Lapping Plates
Toolmakers' Knees • Straight Edges

NUPLA MALLETS
with INTERCHANGEABLE TIPS

Nupla Mallet Tips give you tough, resilient and self-healing qualities that no other mallet possesses. Made in three grades, "S"—Soft, "M"—Medium, "T"—Tough.

1. Will not mar machined or delicate surfaces.
2. No "Flying Particles" to endanger workmen's eyes.
3. No sting, vibration or rebound.
4. No explosion or fire hazard.
5. Can be had non-conductor of electricity (specify when ordering).

"A Mallet for Every Purpose; A Purpose for Every Mallet"

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ACME TOOL COMPANY

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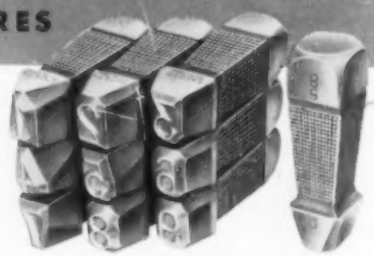
For Maximum Safety in Stamping—

"SAFETY" Wedge Grip
STEEL LETTERS AND FIGURES



- **No mushroom**
- **No spall**
- **25% to 50% more service**
- **More Safety!**
- **Pat. No. 2,089,794**

Perfect balance . . . Knurled sides not only assure *positive* grip with "Wedge Grip" to give clearer, deeper impressions—but also lessen severity of extra heavy stamping. Characters available from 1/16" to 1"

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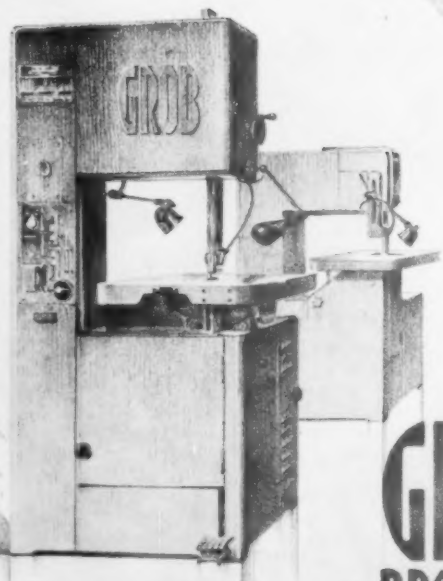
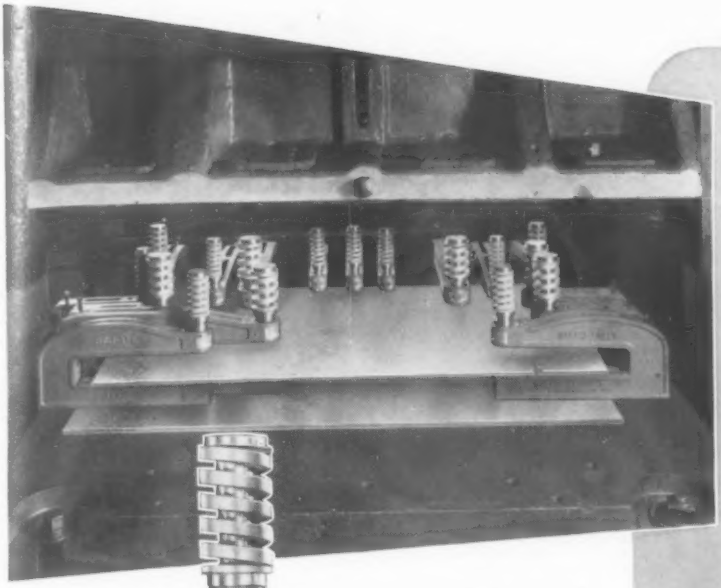


GROB BROTHERS

GRAFTON WISCONSIN



Above—Illustrating mounting plate setup of Wales Type "CJ" Hole Punching Units ready to punch the ¼" thick work in position.

NOTHING CAN BE

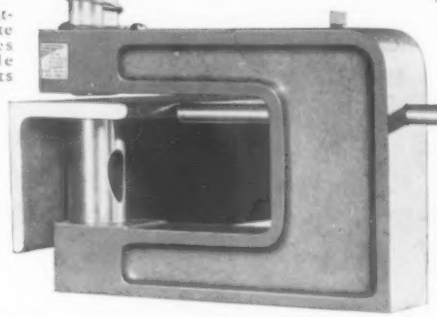
WHAT COULD BE SIMPLER

FOR HOLE PUNCHING THAN

THE

WALES

PATENTED AND EXCLUSIVE TEMPLATE MOUNTING METHOD*



Showing a typical Wales Type "CJ" Hole Punching Unit with ¼" angle nested to be punched. Note the high die which provides unobstructed slug clearance and permits close punching to leg of angles.

...one important application is in combination with

WALES Type "CJ" UNITS

for punching mild steel up to

1/4" THICK

● Wales Patented Mounting Method requires only ***one template*** and only Wales Units have this simple setup method. The template serves a dual purpose by combining the mounting plate and the hole punching pattern.

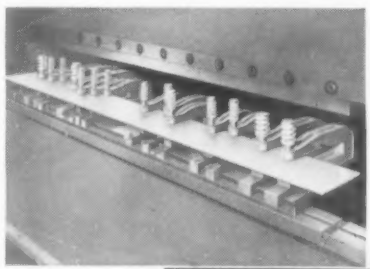
Faster setups, almost complete elimination of press "down time", and easier storing of combined templates and mounting plates without Wales Units are NEW money-saving and time-saving advantages that cannot be overlooked in today's high cost of production.

Tooling is reduced to a simple, quick assembly operation by Wales Units. This self-contained and versatile equipment may be used and reused in an unlimited number of setups keeping the die investment in continuous productive operation.

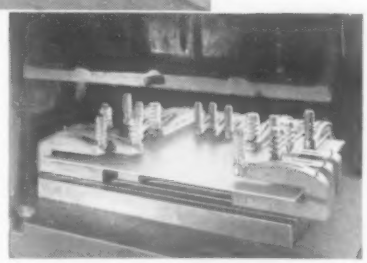
Write for complete information, catalogs and bulletins.

* *Note: Wales-Strippit Corporation has not granted permission to anyone to use this patented mounting method except with Wales Hole Punching and Notching Equipment.*

WALES TYPE "CJ" HOLE PUNCHING UNITS USED ON T-SLOTTED PLATES IN STAMPING PRESSES AND ON BED RAILS IN PRESS BRAKES



Showing a setup Wales Type "CJ" Units in press brake for punching staggered holes. Note the ¼" thick work in position in the Units.



Showing Wales Type "CJ" Hole Punching Units mounted on a T-slotted plate in a stamping press with work ready to be punched.

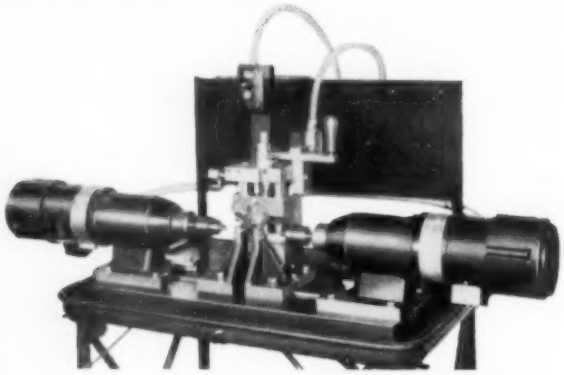
WALES-STRIPPIT CORPORATION

GEORGE F. WALES, President

393 PAYNE AVENUE, NORTH TONAWANDA, N. Y.

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment



Drilling and De-burring Cotter Pin Holes

In the above set-up, designed and built by D. A. Smith & Co., Detroit, for J. B. Du Pont Co., Birmingham, Mich., two Govro-Nelson Automatic Drilling Units are drilling a cotter pin hole from one side and countersinking from the other.

The machine will take stock of various diameters up to 3/8", drilling and countersinking holes from .070" to 9/64". With 5/16" stock, 7/64" cotter pin holes are drilled and deburred at the rate of 550 per hour.

Send for literature showing many other examples of how Govro-Nelson Drilling Units are increasing production rates and decreasing labor costs in plants throughout the nation.

WRITE FOR Literature

GOVRO-NELSON CO.
Machinists of Precision Parts for 25 Years
1933 ANTOINETTE STREET
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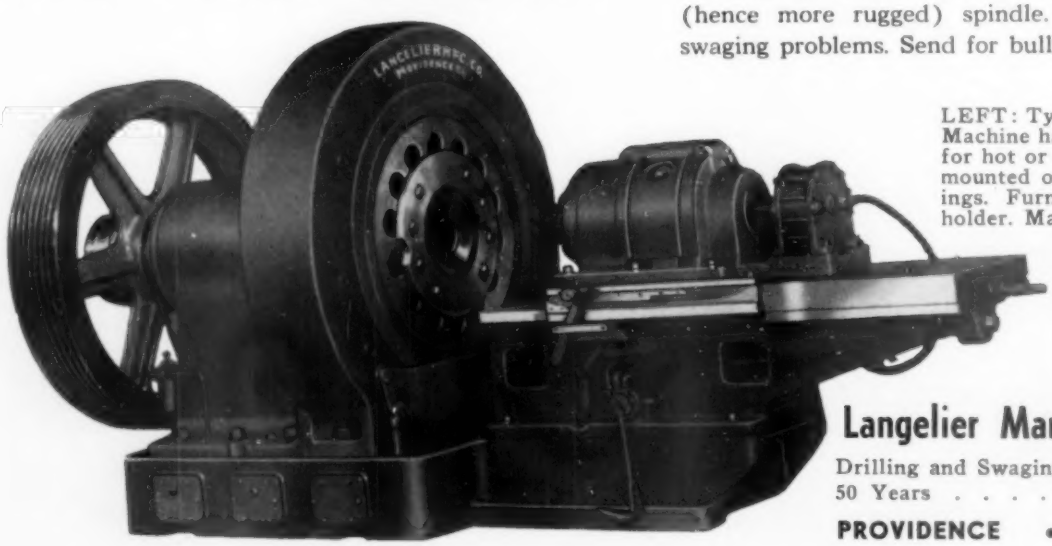
Automatic DRILLING UNIT

NEW DESIGN
LANGELIER
Swagers
EFFECT BIG SAVINGS!

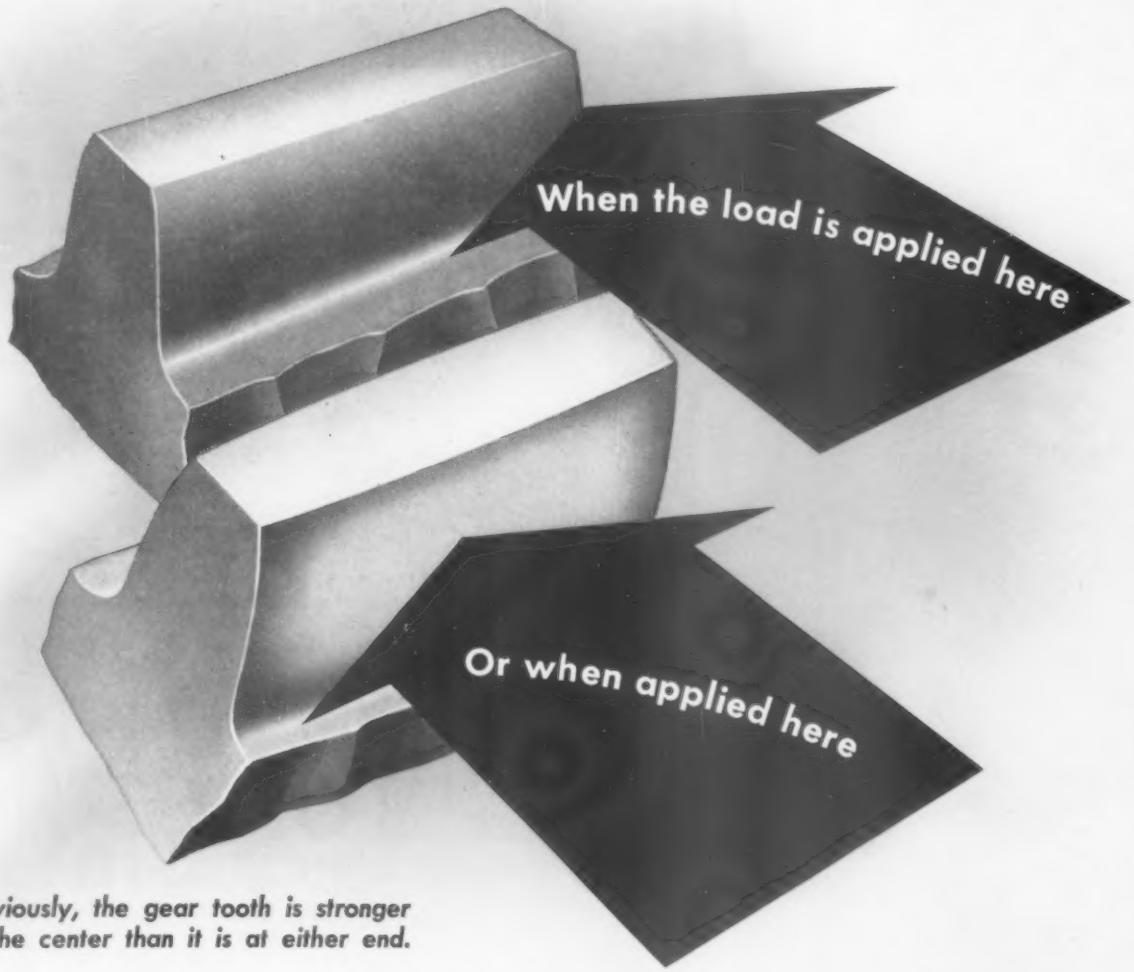
Whether your swaging needs involve pin-pointing or pointing 7" dia. tubes—there is a modern, improved Langelier Swaging Machine that will do the work speedily, accurately, efficiently—and deliver important economies in machining costs. More than 50 years of swaging "know-how" are built into every Langelier Swager. Here's just one important advancement: Timken-mounted spindle reduces power consumption, decreases friction, lengthens life of parts as compared with old-style plain bearing mountings; also assures close concentricity between revolving spindle and circle of head rolls. Permits use of much shorter (hence more rugged) spindle. Let us solve your swaging problems. Send for bulletins.



LEFT: Type J, K and L Swaging Machine has water-jacketed head for hot or cold swaging. Spindle mounted on Timken roller bearings. Furnished with or without holder. Machine as shown here is equipped with hydraulic feeding mechanism and pneumatically operated rotating chuck: Capacity, tubing: Type J, 4". Type K, 4½". Type L, 6½".

Langelier Manufacturing Co.
Drilling and Swaging Specialists for Over 50 Years . . . . . Incorporated 1887
PROVIDENCE • RHODE ISLAND

WHERE IS A CRITICALLY LOADED GEAR TOOTH MOST APT TO BREAK?



Obviously, the gear tooth is stronger at the center than it is at either end.

Therefore, only when loads are confined to the central tooth section and avoided at the tooth ends is maximum tooth strength developed.

That is precisely what is accomplished when gear teeth are given the Elliptoid form. The amount of crown need be very little. From .0003″ to .0005″ per inch of tooth face is sufficient to centralize the loads and protect the gear.

Elliptoid teeth are produced on Red Ring Gear Shaving Machines for both spur and helical gears up to 36″ pitch dia.

Ask Red Ring Engineers for performance data on gears of this type.

2524

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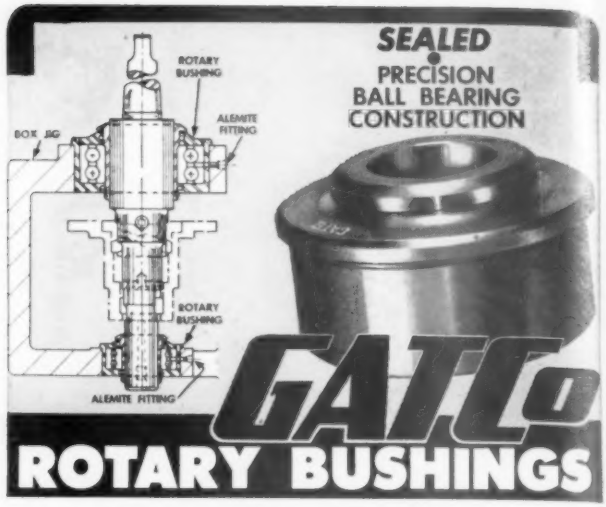
SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE • ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS



FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

Write for full information and prices

GIERN & ANHOLTT TOOL CO.
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SPEED TOOL DELIVERIES WITH STANDARD FIXTURES

SIMPLE ADAPTERS CAN BE USED TO HOLD COMPLICATED PARTS WHILE MACHINING

The Fixture itself never becomes obsolete

An aeroplane main bearing cap is shown, chucked ready to drill 6 bolt holes. Part is positioned from four bosses in lower adaper and squared and clamped on finished face by fixture head.

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley — *ASK FOR CATALOG 238* — Detroit, Mich.

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NEW! Electronic

● EXTERNAL ● INTERNAL

Precision gaging on a mass-production scale is now both practical and economical for any plant or laboratory! The new Brown & Sharpe Electronic Measuring Equipment applies electronic super-sensitivity to measurement, and electronically amplifies the results for instant, accurate reading on a large calibrated dial. It enables accurate gaging to .00001", as fast as test-pieces can be handled.

An outstanding advantage of this new Electronic Measuring Equipment is the separate amplifier unit, which isolates heat-producing elements and prevents temperature drift in gaging units. Another unique feature is the true linear response of the gaging units, which permits accurate setting for the entire scale with only one gage block or master. These are only two of *many* advantages.

Get the full story of this versatile new Electronic Measuring Equipment. Write for details. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

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Speedy internal gaging with Internal Comparator Attachment No. 952, Amplifier No. 950 and Signal Light Attachment No. 958 (optional).

Gage Head Cartridge No. 953 is shown mounted in special fixture for linear gaging.

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A Better Method Available!

THE "Q-C" VISE FIXTURES

This fast positive method of workholding offers many exclusive advantages such as—
SPEED—a matter of seconds to load and securely lock.
ADAPTABILITY—Jaws open 2" with 180° movement of handle, form jaws may be used for any number of parts.
Get full data on all Q-C Standardized Units including—
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VERTICAL TYPE

3 sizes: 4" - 6" - 8" (Jaw Opening)

HORIZONTAL TYPE

3 sizes: 4" - 6" - 8" (Jaw Opening)

Send for the "Q-C" Tool Engineers Reference & Standards Book. Your tool design needs it.

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TO STANDARDIZE IS TO ECONOMIZE

This Grand Rapids No. 15 Motor Driven Hand Feed Surface Grinder can, in many instances, be used more profitably than the more costly Hydraulic Feed Surface Grinders . . . and we make both types.

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Manufacturers of Grand Rapids Grinders
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SCHERR *aids to precision*

OPTI-FLAT GLASS SURFACE PLATE

Here is the basis for vertical measuring accuracy—an optically ground glass surface, flat within 50 millionths over the total area. A solid, non-warping, thick disc of Pyrex brand glass, set in a heavy wood base with dust-proof cover. Immune to the internal strains which may affect the accuracy of metal surface plates, with the added advantage that accidental scratches cannot cause raised burrs, nor long usage wear the hard surface. For real accuracy in layout work and critical inspection, start from the perfect surface of a Scherr Opti-Flat. Two sizes—12" diam., 2" thick, and 16" diam., 3" thick. Also a complete stock of hand-scraped metal surface plates, angle irons, measuring irons, etc.

OPTICAL FLATS

Essential for checking wear and flatness of lapped surfaces. Reveal deviation in millionths from absolute flatness or parallelism of micrometer anvil, gage blocks, refrigerator, airplane parts, etc. Sizes up to 4" or over in optical glass or quartz.

SINE BAR

Thoroughly normalized, and carrying the Scherr accuracy guarantee. Type G has ground edges. Type L, lapped edges. Two sizes—1"x⅝"x5", and 1"x1¼"x5". Extremely low price makes this valuable tool available for the individual owner as well as in quantity for the toolroom.

Write for full details on these Tools, and for the Scherr Small Tool Catalog.

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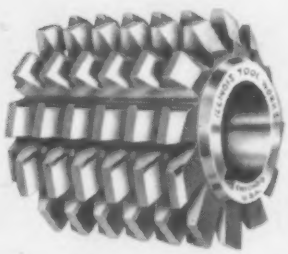
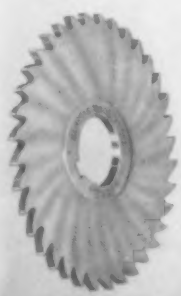


Here for the first time is an unusual service to cutting tool buyers...a complete listing of current information on standard cutting tools carried in Chicago stock for overnight delivery to all America!

It contains complete dimensional data, prices and discounts on standard cutting tools and shows number of tools in stock and which tools are in process at date of issue. Write for your copy today ... and you will receive a new issue every other month to simplify and speed your cutting tool orders and delivery. *Write today!*



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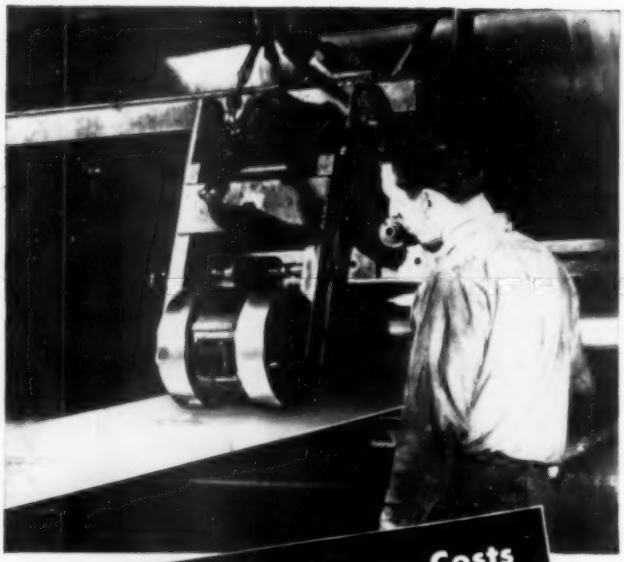

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• V and flat ways of the heavy-ribbed Logan Lathe bed are held to within .0005" of parallelism. The front bearing seat on the Logan Lathe ball bearing mounted spindle can vary no more than .0002". Total spindle runout 12 inches from the bearing is less than .0008". To hold to tolerances like these, one of every seven men building Logan Lathes is an inspector, skilled in the use of the most modern precision instruments. Operations, individual parts, sub-assemblies and completed machines are checked. That is why the Logan Lathe has earned a reputation for sustained accuracy and dependable, low-cost service in all fields of industry. Write for full information on the complete line of Logan Lathes and Shapers. S-3

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10½" . . . bed length, 43⅛" . . . size of hole through spindle, $\frac{25}{32}$" . . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision-ground ways, 2 V-ways and 2 flat ways.

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Do you require precision?—DI-ACRO Rod Parter holds tolerance to .001" on duplicated cuts. The ends are square, and roundness is maintained.

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All hot and cold rolled rods
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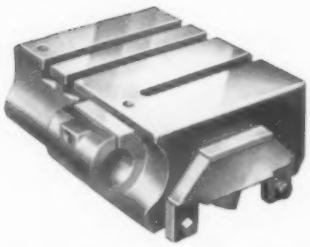
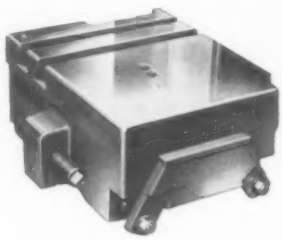
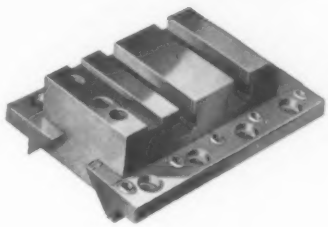


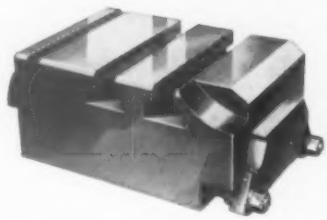
ALL SIZE MULTIPLE SPINDLE F OR G GRIDLEY



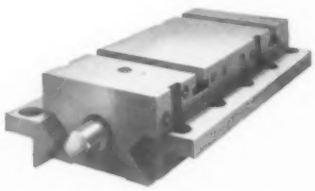
ALL SIZE SINGLE SPINDLE GRIDLEY



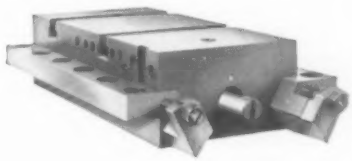
CUT-OFF SLIDE FOR 9/16", 3/4", OR 7/8" F OR G GRIDLEY



CUT-OFF SLIDE FOR 1-1/4" TO 2-5/8" F OR G GRIDLEY



1ST AND 5TH POSITION 9/16" C ACME



1ST AND 5TH POSITION 1" AND 1-5/8" C ACME

1ST AND 6TH POSITION R, R-A, R-A-S ACME-GRIDLEY; ALSO 4-H AND G-A GRIDLEY

Due to heavier construction, Slitters Slides are guaranteed to form or cut off any work which is within the machine's capacity. Their three and one-half times greater bearing surface, combined with their heavier construction, eliminates all rocking and swaying regardless of the amount of the cut taken. This feature makes Slitters Slides particularly important for close tolerance work, or large jobs can be done faster, with fewer operations, and longer tool life.

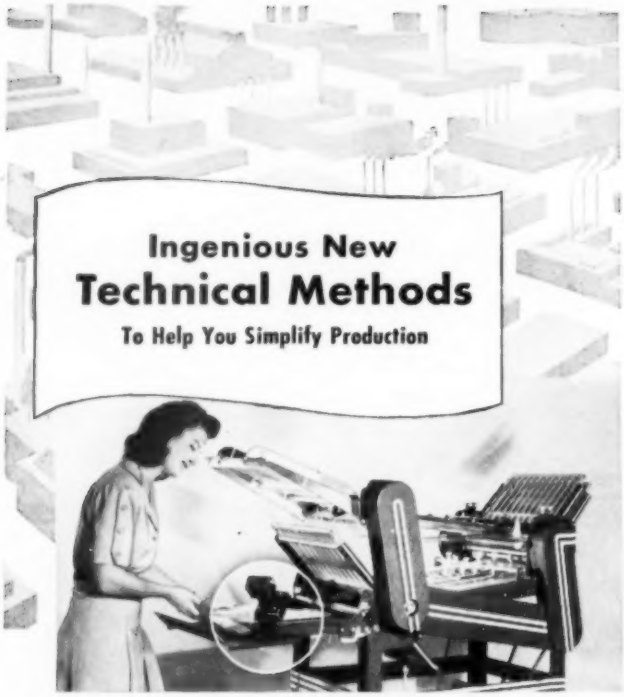
Adjusting gibs and moving parts of all slides for F or G Gridleys and Single Spindle Gridley, except the 9/16, 3/4 and 7/8" cut-off slide, are made of hardened and ground alloy steel working on scraped surfaces of nickel iron. The 9/16, 3/4 and 7/8" cut-off slide for F or G Gridleys, forming and cut-off slides for "C" Acme, "R", "R-A", "R-A-S" Acme-Gridley, also "4-H" and "G-A" Gridley are hardened throughout guaranteeing accuracy and longer tool life. Easily made adjustments will positively remain locked in position due to adjusting tapered gibs running the full length of the slide.

Try these slides. Convince yourself of the many features which make them the best slides you ever used.

SCREW MACHINE TOOL COMPANY

17565 Swift Avenue **Detroit 3, Mich.**

Designers and Manufacturers of SLITTERS Tools



Instantaneous Production Control With Improved Electric Counter

Accurate, up-to-the-minute counting of the production on this Davidson Folding Machine is done with the WIZARD Electric Counter.

New opportunities for more efficient production and elimination of over-run waste are created by WIZARD Electric Counters. These electrically-operated devices count any object or motion that will operate a switch, relay or photo-electric unit. Objects can be counted photo-electrically without physical contact and without risk to fragile or freshly-painted objects.

The Wizard Electric Counter

The Counters can be installed at any distance from the switch or Photo-electric unit where the count originates. Or, they can be mounted on panels in the Production Department and arranged so that a production supervisor can maintain up-to-the-instant counts of all operations throughout the entire plant.

You can also count on chewing gum to help employee's on-the-job efficiency. Chewing gum helps relieve tension—keeps the throat moist—and prevents "false thirst" yet leaves the hands free for work. That's why more and more plant owners are making Wrigley's Spearmint Gum available to everyone.

Complete details may be obtained from Production Instrument Company, 710 West Jackson Boulevard, Chicago 6, Illinois.

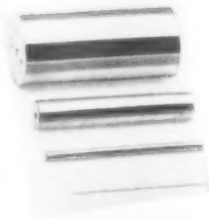
AB-81

Van Keuren THREAD MEASURING WIRES

STANDARD EQUIPMENT EVERYWHERE

Van Keuren measuring wires are the accepted standard equipment for making measurements on thread gages, taps, worms, splines and spur gears. We carry a complete stock of sizes for measuring U. S. Standard, Whitworth, Metric, British Association, Pipe, Acme and 29° Worm threads. Special wires of any diameter in the range from .002" to 1.5708" are made to order.

Our large supply of blanks insures prompt delivery. Van Keuren thread measuring wires are manufactured to National Bureau of Standards specifications. They are hardened, ground and lapped by precision methods developed over a quarter-century. They are accurate within .00002" for roundness and straightness and within ± .000025" for size. Special sizes are made to any tolerance required.

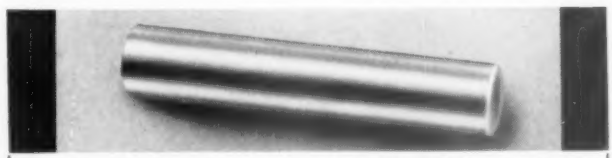


It is easy to use Van Keuren wires. The Van Keuren handbook—"Precision Measuring Tools" gives complete tables and simplified formulas for measuring all standard threads, splines and spur gears. Send for this valuable 144-page handbook No. 33.

THE Van Keuren CO., 174 Waltham St., Watertown, Mass.

28th YEAR

Light Wave Equipment • Light Wave Micrometers • Gauge Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages.



DANLY PRECISION DOWEL PINS

STANDARD AND .001 OVERSIZE

Hardened and Precision ground to a tolerance of ± .0001 of an inch. Available in .001 oversize for repair or renewal work.

DANLY MACHINE SPECIALTIES, INC.

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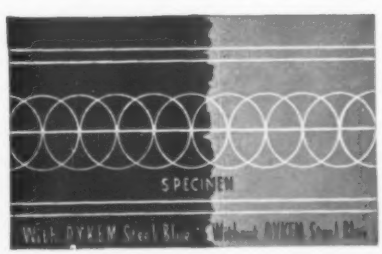
DYKEM STEEL BLUE

STOPS LOSSES

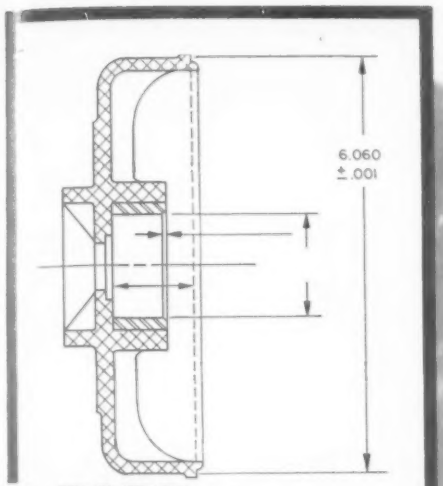
making dies & templates



Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

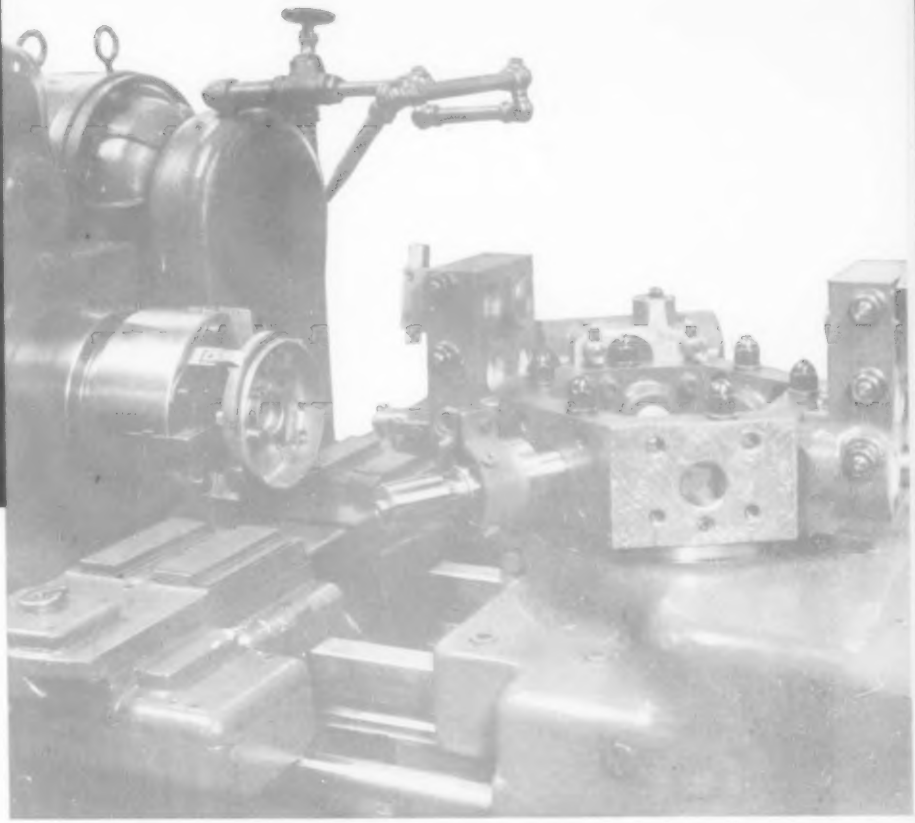
Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.
In Canada: 2466 Dundas St. West, Toronto, Ont.



THE PART....

(die cast aluminum motor end bell with steel insert)



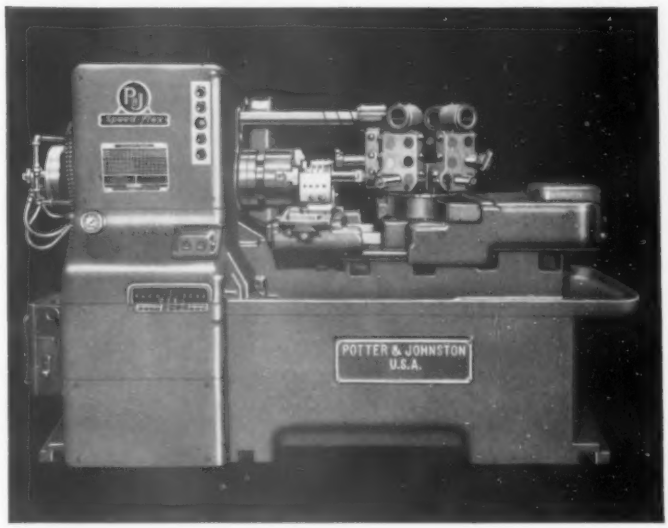
THE METHOD.....

(one operation, starting with boring hole in steel insert)

THE MACHINE.....

3-U SPEED-FLEX

automatic turret lathe



Here is a die cast aluminum motor end bell with a steel insert. The 3-U SPEED-FLEX, occupying only 16 square feet of floor space, TURNS OUT 42 PIECES AN HOUR! The 3-U SPEED-FLEX has been developed for machining castings and forgings—both ferrous and non-ferrous—up to 6 inches in diameter. Small size, wide range of operations: simple, convenient controls, quick chucking, speed and accuracy of all operations: these are factors of utmost importance, whether you are considering a single machine or a battery. Drop us a line. We will be glad to furnish a complete description. Better yet, send us blueprint—or part itself—for guaranteed production data.

Total cutting time (one operation)	1.05 minutes
Allowance for chucking	.15 seconds
Total time	1.20 minutes
Pieces per hour	42.5

Potter & Johnston Machine Co., Pawtucket, R.I.

TOOL FOR PROFIT WITH

ELGIN Sapphire

WEAR RESISTANT

CONTACT POINTS

Sapphire Tipt dial indicator contact points outwear hardened steel 100 to 1 and tungsten carbide more than 10 to 1. Do not scratch or mar finest finishes. Standard or to your specifications.

REFER D-15—SAPPHIRE SHORTS

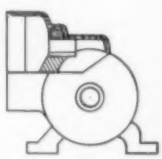
SAPPHIRE TIPT CENTERS

Smooth, highly polished Sapphire Tipt centers in constant use in the tool room of a well known manufacturer for more than one year show no wear. For those grinding and turning jobs that must be "right" specify Elgin Sapphire.

REFER D-11—SAPPHIRE SHORTS

SIZING BEARINGS

When mounting powdered metal bearings, an out of roundness and tapered condition occurred. A Sapphire sizing—burnishing tool chucked in a high speed drill press was the answer. Result: Sized to .0003; high finish.



REFER D-12—SAPPHIRE SHORTS

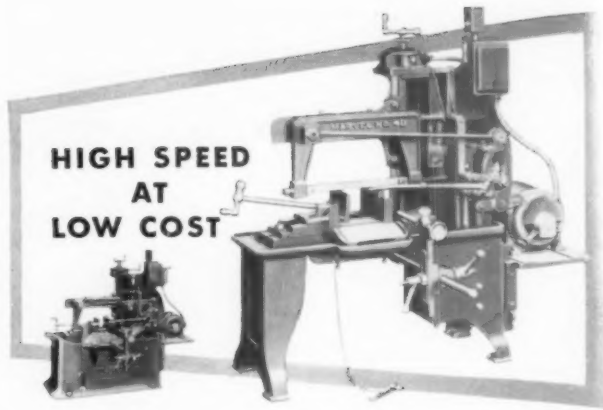
WRITE FOR DETAILS AND ENGINEERING ASSISTANCE

Sapphire

PRODUCTS DIVISION

ELGIN NATIONAL WATCH COMPANY

AURORA • ILLINOIS



For tool room, stockroom, or maintenance shop, this 6" x 6" capacity hack saw is ideal when you want speed, accuracy, and economical operation at lowest possible investment.

Embodies similar design principles and features of MARVEL heavier duty production saws. Its shaper-link action that provides quick return stroke, and its heavy pressure screw feed are two exclusive MARVEL features that provide FASTER cutting than can be obtained with any other metal saw in its price class.

Single speed, 2-speed, and 4-speed models are available, to suit all types of applications where materials of different hardness and alloy characteristics are to be cut. Cabinet base or open-leg base are optional.

Metal Cutting MARVEL SAWS

Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago 39, U.S.A.

When you want something "Special"!

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You can be certain of getting the *exact* tool you want . . . *exactly* as you want it . . . *exactly* when you want it.

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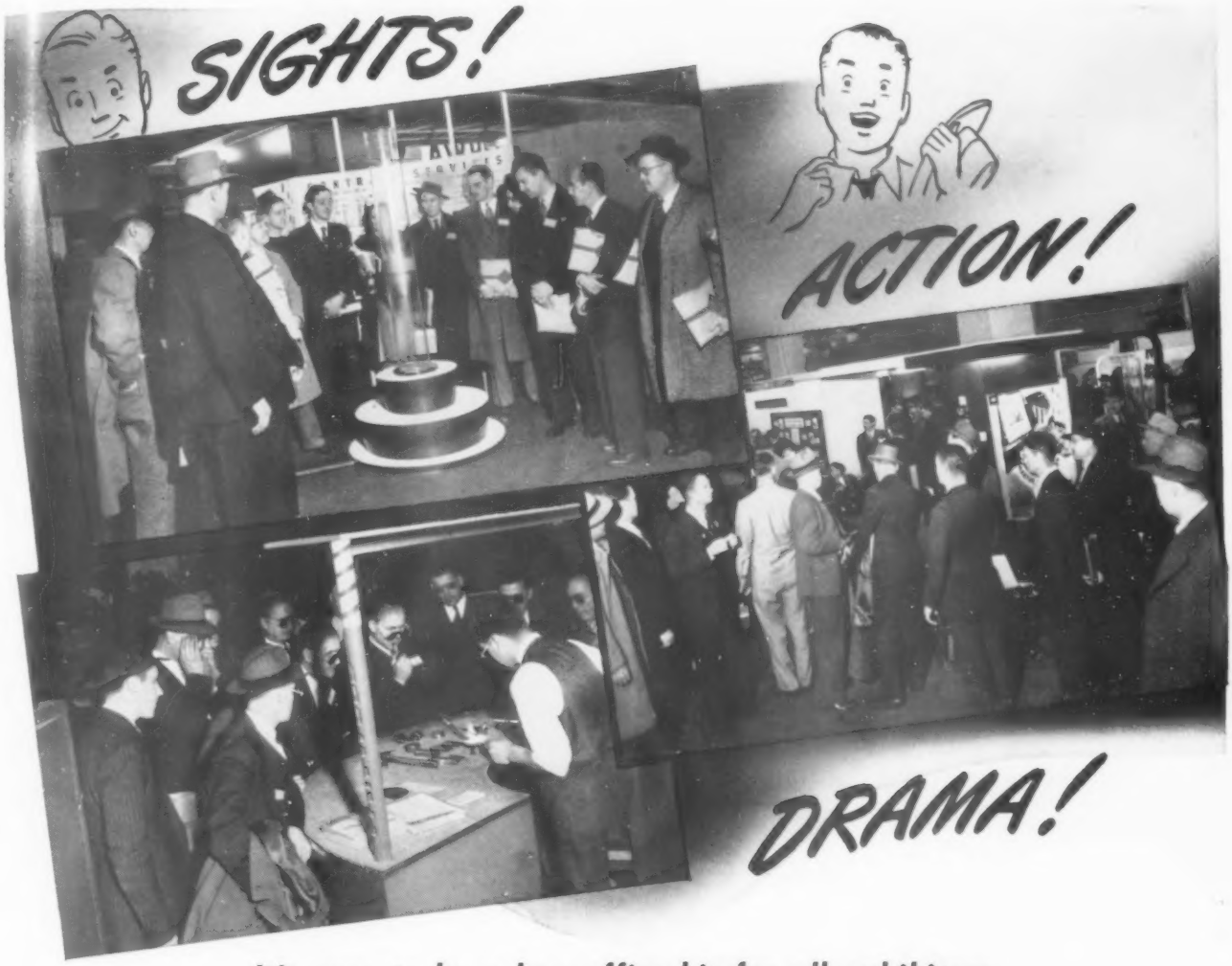

It's sure to be a box office hit for all exhibitors at the Tool Engineers' Industrial Exposition in Cleveland, Ohio, next March 15-19!

Highlights: Presented by the American Society of Tool Engineers, the last Exposition drew thousands of top executives, industrial engineers and tool engineers. A record we're proud to claim! (We'll top even that next spring.)

Action: Among those who will attend the Exposition next March will be the "men who count" in industry . . . men who dictate what shall be bought and from *whom*. There's sure to be sales action aplenty—(your competitor will most likely be there)—so bring your top engineers!

Drama: New processes, advanced methods, fresh approaches and inspiring ideas . . . provide drama by America's leading manufacturers. Plant tours, technical meetings, industrial movies, exhibits—all add up to ASTE's most spectacular Industrial Exposition yet!

Extra Program Feature

Coincidental with the Exposition, ASTE members will meet for their 16th Annual Convention and technical sessions in Cleveland. It's your big chance to sell the tool engineer . . . so make it a date for '48!

Preview of coming attractions!

TIME: March 15-19 • PLACE: Public Auditorium, Cleveland, Ohio • PRODUCED BY: American Society of Tool Engineers • DIRECTED BY: America's leading manufacturers • STAR PERFORMERS: All Tool Engineer Industrial Exposition exhibitors • PRICE: No advance in prices • RESERVATION: Write immediately.

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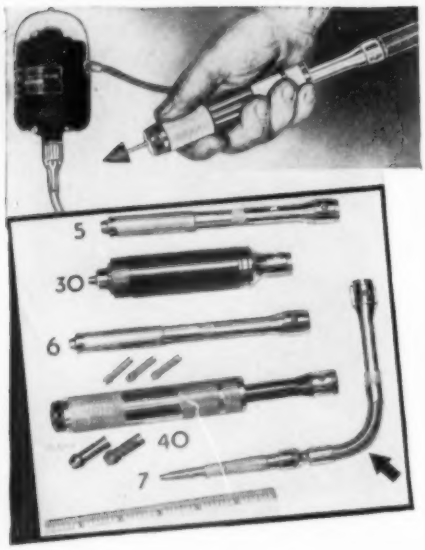
For complete information, write

EXPOSITION COMMITTEE

AMERICAN SOCIETY OF TOOL ENGINEERS

1666 PENOBSCOT BLDG.
DETROIT 26, MICHIGAN

FOREDOM Flexible Shaft MACHINES



5 quickly interchangeable handpiece types—Pencil sizes and larger—some with flexible wrist—see arrow

Thousands of Enthusiastic Users Prove that FOREDOMS are *tops* in the Small Grinder Field

Here are 4 REASONS WHY!

1. Extra power and longer motor life. Motor not dwarfed to fit hand.
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3. Complete range of handpieces types. You fit the tool to job at hand.
4. Small handpiece size lets you get into those "hard-to-reach" places.

USE FOREDOMS to grind, polish, drill, rout, mill, saw, slot, clean, sand, etch, engrave, etc.

FOREDOMS are profitable additions to all departments—production, maintenance, or tool. Use the Flexible Shaft Machine that is fast becoming the standard for the nation. YOU TOO will say "My Foredom is the handiest tool in the tool crib—can't get along without it."

The FOREDOM line includes "hang-up" models as illustrated and easily-portable bench models. Foot rheostat is standard with most of them.

Our Catalog 101 gives you valuable information as to how you can profitably employ FOREDOMS. It will pay you to send for it.

Order NOW from

FOREDOM ELECTRIC CO. **Dept. 101**

More than a quarter century of experience in building Flexible Shaft Machines for home and industry.

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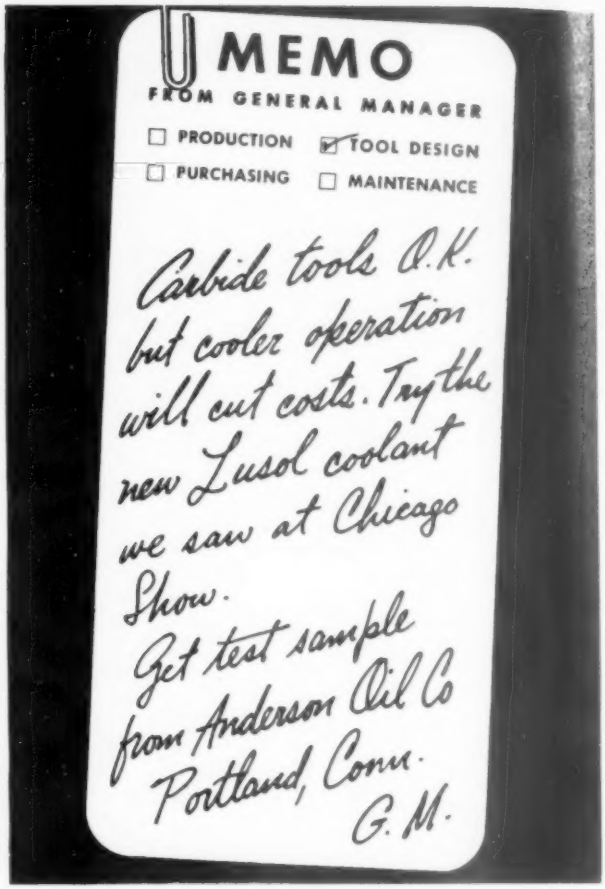
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FROM GENERAL MANAGER
☐ PRODUCTION
☑ TOOL DESIGN
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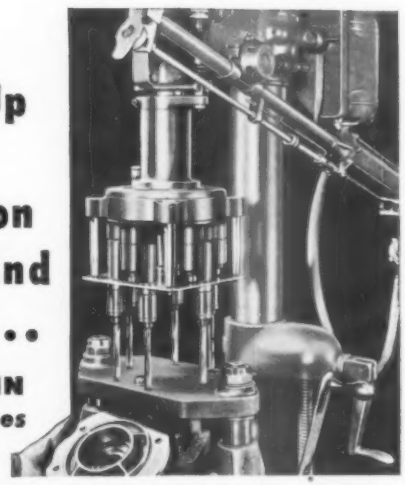
Carbide tools O.K. but cooler operation will cut costs. Try the new Lusol coolant we saw at Chicago Show.
Get test sample from Anderson Oil Co Portland, Conn.
G. M.

Tooled-Up for Production Drilling and Tapping . . .

"WISCONSIN MOTOR" uses



KWICK-CHANGE *Multiple* Drill Heads

Illustration shows one of many Kwick-Change Adjustable, Multiple Heads used for high-volume production drilling of vital parts for these world famous air-cooled engines. The head pictured is used for drilling six different bearing plates.

Entirely gear-driven, Kwick-Change heads have locking templates to assure precision set-ups that "stay-put". They are made in Light, Medium and Heavy Duty Types. Standard Models have 2 to 6 spindles. Models with more than 6 spindles built to special order.

Write for Illustrated Bulletin.

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DISTRIBUTORS FOR
WISCONSIN DRILL HEAD CO.

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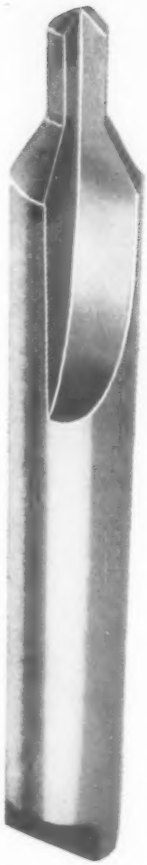

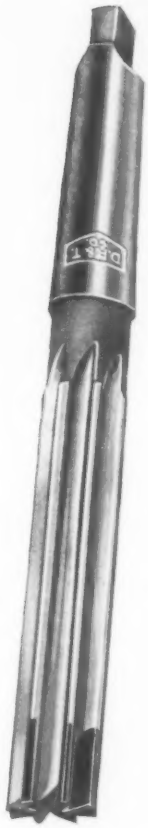

CARBIDE-TIPPED TOOLS *with* HIGH-SPEED STEEL BODIES GIVE YOU 3 BIG *Advantages!*

1. Longer Tool Life
2. Smoother Operation
3. Reduced Production Costs

Carbide tips, it has long since been proven, increase the life of cutting tools tremendously. But when they are brazed on high-speed steel bodies, they give advantages even more important than longer life.

By providing a harder base for the carbide tips, they greatly reduce "spring-back" under heavy cuts, thereby making for faster and smoother operation.

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The final result, of course, is greatly reduced production costs—a vital consideration in these days of strenuous competition.

Our engineers will be glad to work with you on your problems

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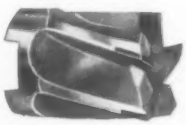
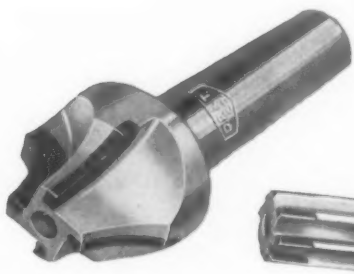
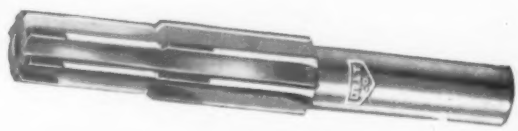
COUNTERBORES • CORE DRILLS • END MILLS

Special Tools To Your Specifications







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Manufacturers of Oil-Hole Drills, Subland Drills, Special Reamers, Circularity Relieved Reamers, (High-Speed or Carbide-Tipped) -Also End Mills and Special Tools

MEMO

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☑ PRODUCTION ☐ TOOL DESIGN

☐ PURCHASING ☐ MAINTENANCE

Look up Lusol made by Anderson Oil Portland, Conn. I hear 14 exhibitors put it in 44 machines during the M.T. Show. It must be good. Order today for test soon.

G. M.

These people also make Rustavoid!

"To Err is Human"...

The human element that enters into any manufacturing process must be continually checked.

Axelson gages will guard your profit margin by eliminating rejects before hours of expensive machine time have been wasted.

Axelson gages filter errors out of your production and increase the precision with which any part must be manufactured.

Axelson stocks a complete line of N.F. and N.C. gages to meet your most urgent need.

Special gages quoted upon application.

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TRY THIS *Easier* WAY OF ALIGNING THE WORK WITH THE SPINDLE!

WRITE FOR CATALOG

In setting up for tapping and reaming, you'll find that the work can be aligned with the spindle much more easily if you use a Ziegler Floating Holder.

This is because, with the Ziegler Holder, the work does not have to be aligned as accurately as with ordinary holders. Any inaccuracies, even though they amount to as much as 1/32" radius, or 1/16" diameter, are automatically compensated for by the holder.

Once you use a Ziegler Holder for tapping and reaming, you'll never again be satisfied with any other type of holder. Get one to try out on your next tapping or reaming job!

Made to Fit Any Machine

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

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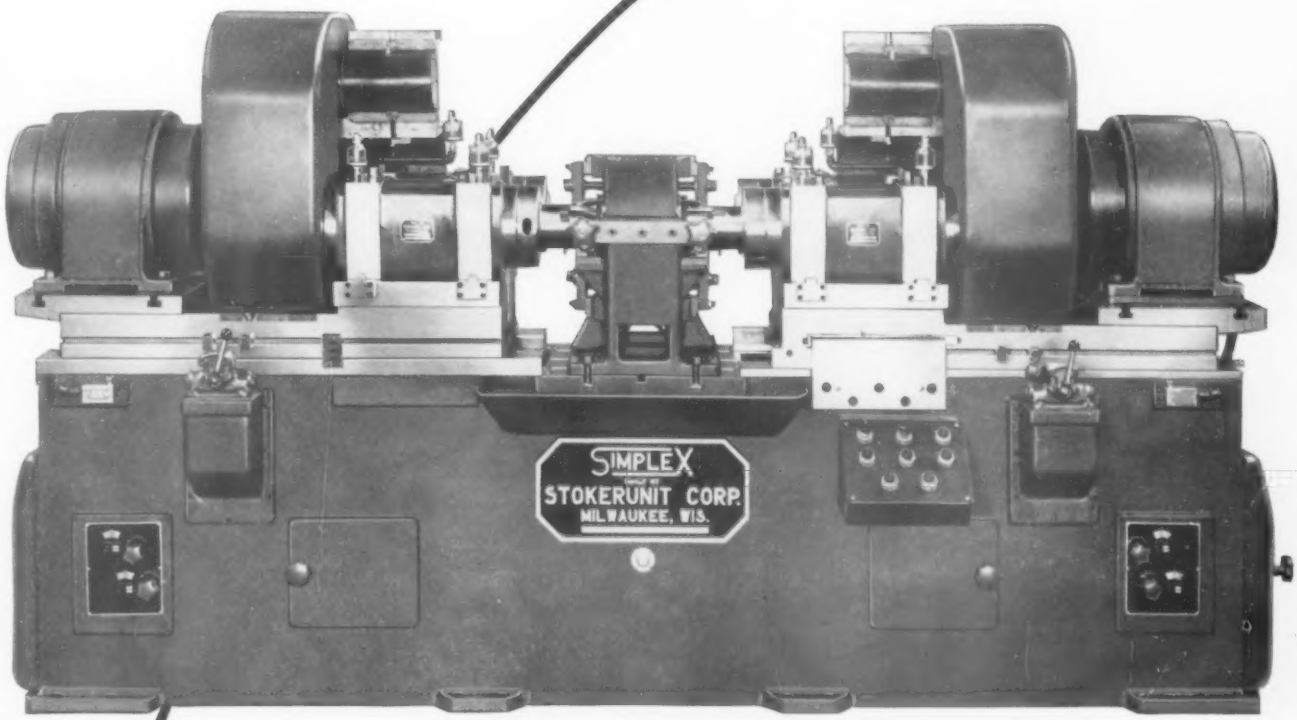
Detroit 16, Mich.

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

SIMPLEX

DIESEL ENGINE CONNECTING RODS are difficult to bore to modern standards of accuracy and finish. Here, in one machine, all rough and finish boring, facing and chamfering operations are performed in minimum time.



The machine is a SIMPLEX 3U 2-way Precision Boring Machine with left-hand table mounted on hardened dovetail ways for rough boring, chamfering and facing one side of both ends. The piece is then reloaded on the right side of the fixture. The right-hand unit finish bores, chamfers and faces the other side. Heavy precision boring spindles, with powerful drives from 7 ½ HP motors, provide excellent finish and accuracy at low unit cost.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

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Ex-Cell-O Way-Type Precision Boring Machines Offer Specialized Multiple Operation at Low Cost

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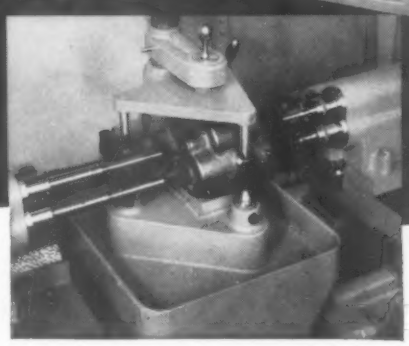
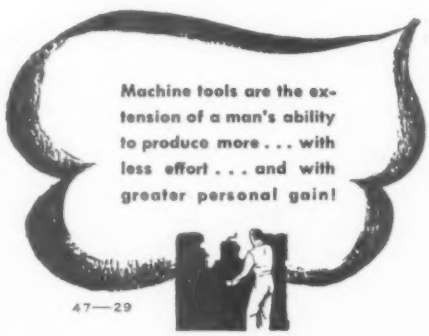


Illustrated here is an Ex-Cell-O Two Way Precision Boring Machine designed for boring holes in cast iron automotive transmission cases. To meet production requirements it was necessary to bore the holes at both ends at the same time.

Above: Special cluster spindles are required here because of close center distances of bored holes. Because boring bars at left are long and slender the ends are further lengthened to engage pilot bushings in the fixture.

Ex-Cell-O Way machines are made to order for work like that illustrated here. They are built up from standard way units that can be operated simultaneously or in sequence as the work requires. Way machines do the work of special machines, but the use of standard units keeps the first cost low and, as production requirements change, the units may be rearranged to accommodate different work. Ex-Cell-O One Way Precision Boring Machines are especially suitable for heavy or awkward work. Two Way Machines accommodate awkward and long work pieces and save time by boring from both sides simultaneously. Three and Four Way Machines are particularly suitable for boring holes perpendicular to one another. An important feature of Way Machines is that multiple operations are performed from the same work locating points, with only one handling of the parts.



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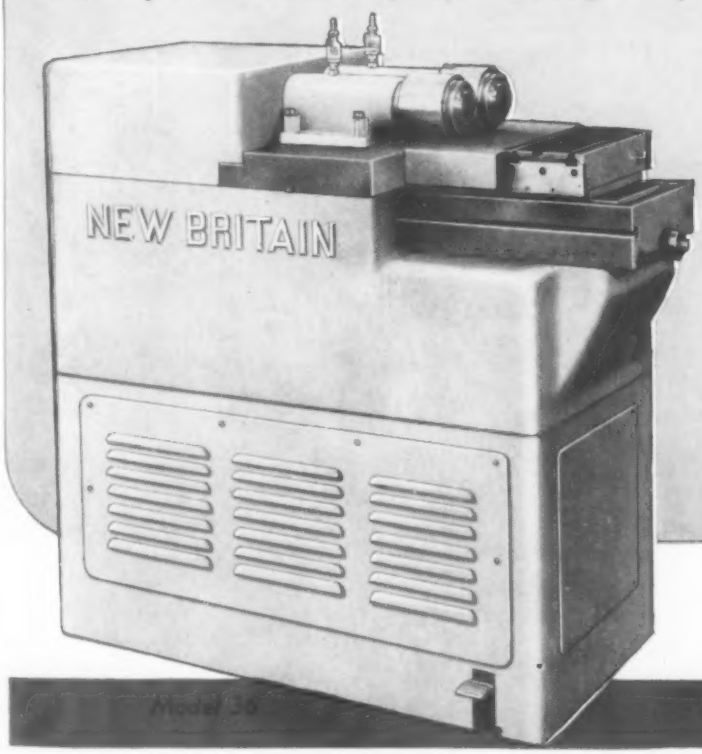
3. Through positive cam action, tool approaches on rapid traverse to within .005 of the work and immediately starts to feed. Tool may cut on feed-in or drawback stroke, or both for rough and finish cuts. On return stroke, tool jumps clear eliminating drag off marks. When moving between intermittent or successive cuts, tool goes into rapid traverse.

4. Uniform temperature, anti-friction bearings, and super-precision spindles provide spindle speeds up to 7,500 RPM. Mechanical precision chucking operated by air cylinders. Neither chucking nor unchucking operation affects preload or position of spindle bearings.

5. Only one dimension need be inspected on any one set-up, regardless of the number of diameters produced by any one single-point tool. Cams control and positively repeat from piece to piece.

6. Set-up of machine depends entirely upon nature of job. Work may be rotated in spindles or mounted on table, loaded from the front of the spindle or through the spindle. Spindles may be raised, lowered, or separated. Two spindles are standard, but more may be added. Changing job set-up simply requires replacing two cams, setting tool for size and changing chucks.



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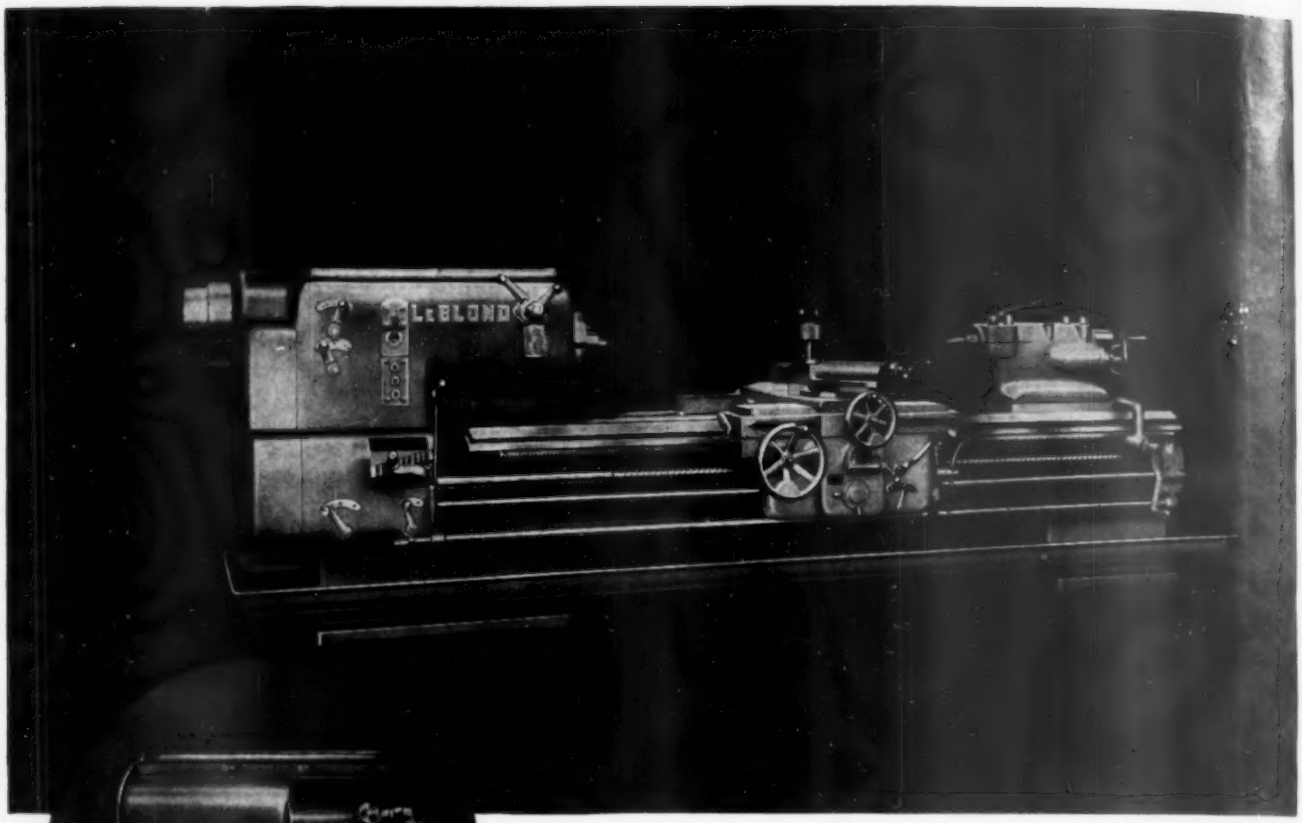

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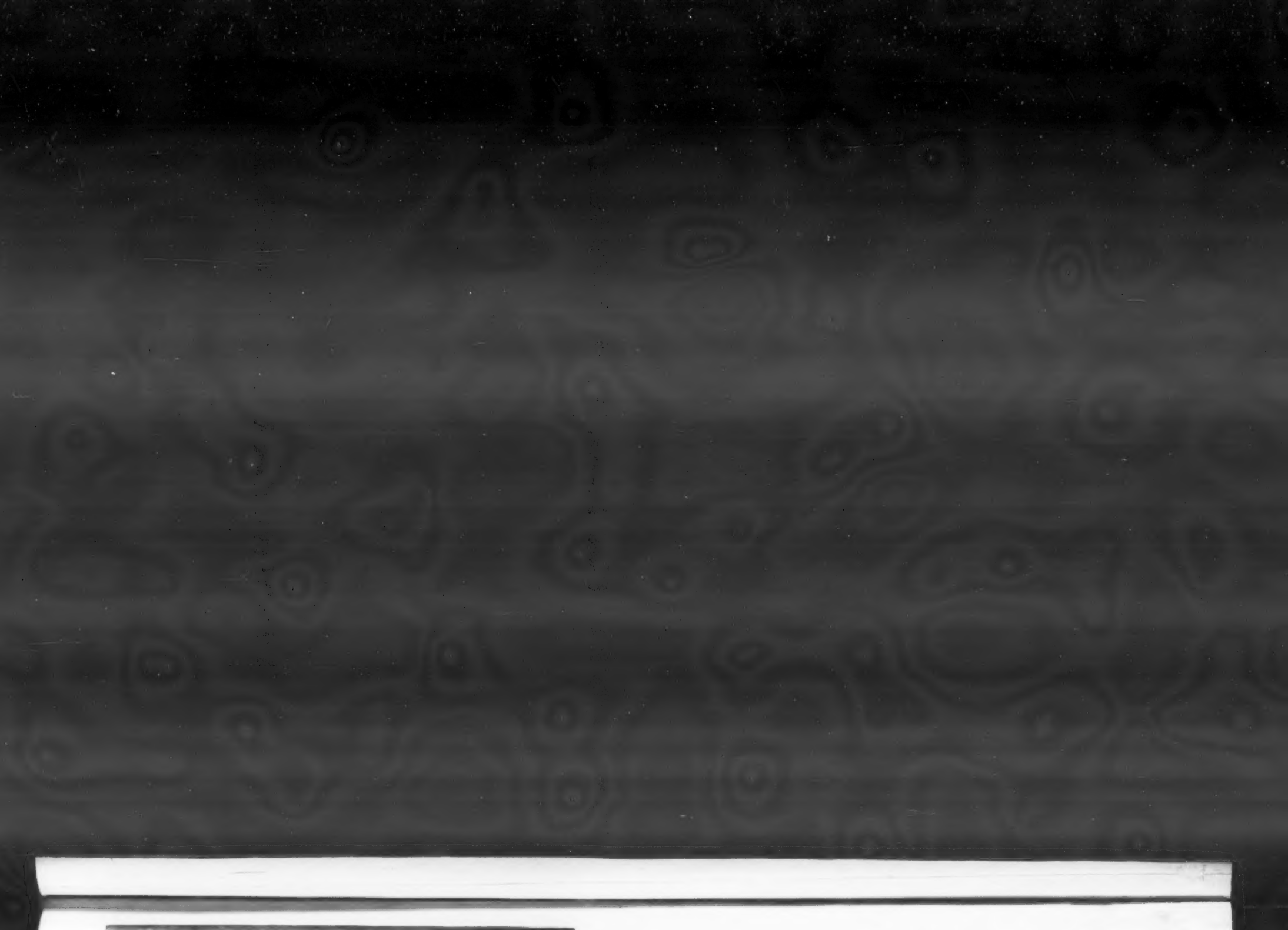
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